Contents - Annex WiMAX and WLAN

Digital Standard IEEE 802.16 WiMAX

Introduction - Digital Standard WiMAX

The R&S Vector Signal Generator provides you with the ability to generate signals in accordance with the Institute of Electrical and Electronics Engineers (IEEE 802.16-2004) standard.

WiMAX is a wireless metropolitan-area network technology that provides interoperable broadband wireless connectivity to fixed and portable users. It provides up to 50 kilometers of service area, allows users to get broadband connectivity without the need of direct line-of-sight to the base station, and provides total data rates up to 75 Mbps - enough bandwidth to simultaneously support hundreds of businesses and homes with a single base station.

The equipment layout for IEEE 802.16 WiMAX signal generation includes the options Baseband Main Module (B13), Baseband Generator (B10/B11) and Digital Standard IEEE 802.16 WiMAX (K49). B10 features a much larger ARB memory size than B11 (see data sheet). But apart from the memory size, both options have the same functionality and are installed alternatively.

In the case of two-path instruments, at least one more option, the Baseband Generator (B10/B11) is required to generate an IEEE 802.16 WiMAX signal in the second path. With this option, an IEEE 802.16 WiMAX signal can be defined on path B and then either be routed to path A or added to the path A signal with a settable frequency offset. Generating the IEEE 802.16 WiMAX signal simultaneously on paths A and B requires an additional, second option, the (Digital Standard IEEE 802.16 WiMAX (K49). With a full path B configuration with a second option (Baseband Main Module (B13) and an RF section (frequency option B20x), the IEEE 802.16 WiMAX signal can be output at RF output B.

The R&S Vector Signal Generator generates the IEEE 802.16 WiMAX signals in the arbitrary waveform mode, the signal is first calculated and then output.

The R&S Vector Signal Generator simulates IEEE 802.16 WiMAX at the physical level. Supported features include:

- Configuration of OFDM (orthogonal frequency division multiplexing) and OFDMA (orthogonal frequency division multiple access) physical layer mode.
- Downlink and Uplink mode.
- Pre-defined settings for receiver tests in the uplink and the downlink.
- All frame duration settings defined by the standard, including a “user” mode with freely configurable Frame Duration, and a “continuous” mode. In “continuous” mode, gaps between bursts are eliminated.
- Sequence length of up to 511 frames.
- Up to 8 bursts per frame with independent power setting.
- Channel bandwidth and sampling rate settings according to the ETSI, MMDS, WCS or U-NII bands, or alternatively arbitrary settings in “User” mode.
- Full RS/CC channel coding.
- BPSK, QPSK, 16-QAM or 64-QAM modulation, independently configurable for any of the 8 uplink or downlink bursts.
- FCH burst generation in “automatic” mode (using signal configuration parameters set by the user) or in “user” mode, with arbitrary data.
- Predefined data sources such as PN9, PN11 and others, or arbitrary user data.
- Optional generic MAC headers and CRC for each burst.
- Subchannelization modes.
- Clipping for reducing the crest factor.

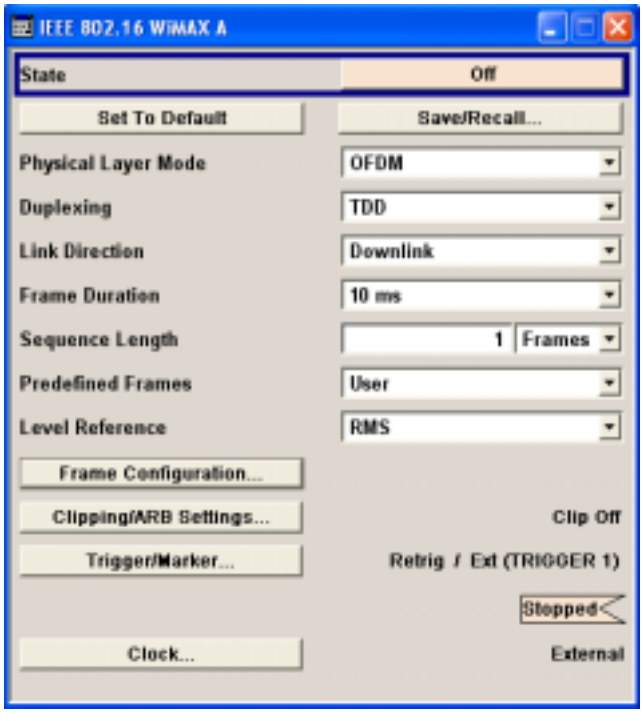
Table 4-1 Parameters of the modulation system IEEE 802.16 WiMAX

Digital standard 802.16-2004	meets IEEE Std 802.16™-2004
Physical layer mode	OFDM, OFDMA
Link direction	forward link and reverse link
Frame durations	2, 2.5, 4, 5, 8, 10, 12.5, 20 ms, continuous, user definable
Sequence length	1 – 511 frames (depending on frame duration)
Clipping	Vector or scalar clipping, applied before filtering
Marker modes	Restart, frame start, frame active part, pulse, pattern, on/off ratio
Parameters in OFDM Mode	
Duplexing	TDD, FDD
Predefined frames	Short, mid and long length test messages for testing receivers with all modulation types and RS-CC rates
Level reference	FCH/Burst or preamble level
Frequency bands	ETSI, MMDS, WCS, U-NII, User
Channel bandwidth	1.25 – 30 MHz, depending on selected frequency band
Sampling rate	1.5 – 32 MHz, depending on channel bandwidth
Tg / Tb settings	1/4, 1/8, 1/16, 1/32
FFT size	256 (fixed)
Nr. of possible subchannels in subchannelization mode	1, 2, 4, 8, 16 (all)
Nr. of bursts per frame	0 – 8
Preamble / midamble modes	Burst preamble / midambles off, burst preamble in downlink, midamble repetition 5, 9 or 17 in uplink
Modulation & RS-CC rates	BPSK 1/2, QPSK 1/2, QPSK 3/4, 16-QAM 1/2, 16-QAM 3/4, 64-QAM 2/3, 64-QAM ¾
Data	all 0 , all 1, pattern (up to 64 bit), PN 9 to PN 23, data lists
Burst power range	-80 dB - +10 dB
MAC functions	One generic MAC header + CRC available per burst
Parameters in OFDMA Mode	
Duplexing	TDD
Level reference	Subframe RMS Power or preamble level (downlink only)
Frequency bands	ETSI, MMDS, WCS, U-NII, User
Channel bandwidth	1.25 – 30 MHz, depending on selected frequency band
Sampling rate	1.5 – 32 MHz, depending on channel bandwidth
Tg / Tb settings	1/4, 1/8, 1/16, 1/32
FFT size	128, 512, 1024 or 2048
Subcarrier Permutation	PUSC, FUSC (downlink only)
Nr. of bursts per frame	0 - 8
Modulation & CC rates	QPSK 1/2, QPSK 3/4, 16-QAM 1/2, 16-QAM 3/4, 64-QAM 1/2, 64-QAM 2/3, 64-QAM 3/4
Data	all 0 , all 1, pattern (up to 64 bit), PN 9 to PN 23, data lists
Burst power range	-80 dB - +10 dB
MAC functions	One generic MAC header + CRC available per burst

WiMAX Menu

The menu for setting the IEEE 802.16 WiMAX digital standard is either called from the baseband block or from the menu tree under Baseband.

The menu is split into several sections for configuring the standard. The choice of transmission direction determines which displays and parameters are made available in the lower section.



The upper section of the menu is where the IEEE 802.16 WiMAX digital standard is enabled, the default settings are called and the physical layer mode, the duplexing and the transmission direction are selected. Additional parameters include Frame Duration, Sequence Length and a set of Predefined Frames for receiver testing.

A button leads to the submenu for loading and saving the IEEE 802.16 WiMAX configuration.

The buttons of the lower menu section lead to submenus for configuring the frame and for setting the filter, clipping, trigger and clock parameters.

The upper menu section is where the IEEE 802.16 WiMAX digital standard is enabled and reset and where all the settings for the signal in both transmission directions are made.

State

Enables/disables the IEEE 802.16 WiMAX standard.
Enabling this standard disables all the other digital standards and digital modulation modes on the same path.
The IEEE 802.16 WiMAX signal is generated in arbitrary waveform mode.

Remote-control command:
`SOUR:BB:WIM:STAT ON`

Set to default

Calls the default settings. The following table gives an overview of the settings. The preset value for each parameter is specified in the description of the remote-control commands.

Remote-control command:
`SOUR:BB:WIM:PRES`

Parameter	Value
General Settings	
State	Not affected by Set to default
Physical Layer Mode	OFDM
Duplexing	TDD
Link Direction	Downlink
Frame Duration	10 ms
Sequence Length	1 frame
Predefined Frames	User
Level Reference	FCH/Burst
Clipping	Off
OFDM mode	
Frequency Band	ETSI
Channel Bandwidth	1.75 MHz
Sampling Rate	2.000 MHz
BSID (4 LSBs)	0
Tg/Tb	1/4
Nr. of used Subchannels	16 (all)
Frame Preamble	Long
FCH Configuration	On, Auto mode, Frame Number Offset = 0 and Configuration Change Count = 0
Nr. of Bursts	1
OFDMA mode	
Frequency Band	ETSI
Channel Bandwidth	1.75 MHz
Sampling Rate	2.000 MHz
n =	8/7
Tg/Tb	1/4
FFT Size	2048
Subcarrier Permutation	PUSC
Subchannel 0 ... 59 State	ON

Save/Recall...

Calls the **Save/Recall** menu.
From the **Save/Recall** menu the **File Select** windows for saving and recalling IEEE 802.16 WiMAX configurations and the **File Manager** can be called.

IEEE 802.16 WiMAX configurations are stored as files with the predefined file extension ***.wimax.** The file name and the directory they are stored in are user-definable.

The complete settings in the **IEEE 802.16 WiMAX** menu are saved and recalled.

Recall IEEE 802.16 WiMAX setting

Opens the **File Select** window for loading a saved IEEE 802.16 WiMAX configuration.

The configuration of the selected (highlighted) file is loaded by pressing the **Select** button.

Remote-control command:
```
MMEM:CDIR 'F:\gen_lists\wimax'

SOUR:BB:WIM:SETT:CAT?
        Response:   'wimax_1',wimax_2'
SOUR:BB:WIM:SETT:LOAD "wimax_1"
```

Save IEEE 802.16 WiMAX setting

Opens the **File Select** window for saving the current IEEE 802.16 WiMAX signal configuration.

The name of the file is specified in the **File name** entry field, the directory selected in the **save into** field. The file is saved by pressing the **Save** button.

Remote-control command:
```
MMEM:CDIR 'F:\gen_lists\wimax'

SOUR:BB:WIM:SETT:STOR 'wimax_3'
```

File Manager

Calls the **File Manager**.
The **File Manager** is used to copy, delete and rename files and to create new directories.

Remote-control commands::
```
MMEM:CDIR 'F:\gen_lists\wimax'

SOUR:BB:WIM:SETT:DEL 'wimax_1'
```

Physical Layer Mode

Selects the physical layer mode.
The settings of the frame are provided in the submenu **Frame Configuration** (see following section) in accordance with the selection.

OFDM

The OFDM mode supports signal generation according to IEEE 802.16-2004 section 8.3 with a fixed FFT size of 256.

Remote-control command:
```
SOUR:BB:WIM:MODE OFDM
```

OFDMA

Orthogonal Frequency Division Multiple Access (OFDMA) groups multiple subcarriers of the OFDM into sub-channels. A single client or subscriber station might transmit using all of the sub-channels within the carrier space, or multiple clients might transmit with each using a portion of the total number of sub-channels simultaneously. OFDMA thus enables a more flexible use of resources. It can support nomadic and mobile operation.

Remote-control command:
```
SOUR:BB:WIM:MODE AOFD
```

Duplexing

Selects the duplexing. The duplexing mode determines how the uplink and downlink signals are separated.

TDD

In TDD mode, the same frequency is used for both directions of transmission (uplink and downlink). With one baseband, either downlink or uplink frames can be generated.

Remote-control command:
`SOUR:BB:WIM:DUPL TDD`

FDD (OFDM only)

In FDD mode, different frequencies are used for downlink and uplink directions. If only one link direction is considered at once, the IEEE 802.16 standard defines no differences between TDD and FDD signals on the physical layer.
The FDD mode has been provided for convenience, it completely fills the defined frame with bursts to simulate a continuous transmission environment. It is recommended to use TDD mode instead if FDD devices are to be tested with frames including transmission gaps.

Remote-control command:
`SOUR:BB:WIM:DUPL FDD`

Link Direction

Selects the transmission direction.

Downlink

The transmission direction selected is base station to subscriber station. The signal corresponds to that of a base station.

Remote-control command:
`SOUR:BB:WIM:LINK DOWN`

Uplink

The transmission direction selected is subscriber station to base station. The signal corresponds to that of a subscriber station.

Remote-control command:
`SOUR:BB:WIM:LINK UP`

Frame Duration

Selects the frame duration.
Only distinct values are allowed in the standard. For test reasons, continuous generation or generation for a freely selectable duration (User) are available. In continuous mode, the frame duration equals the sum of the burst durations in OFDM mode or the subframe duration in OFDMA mode.

Remote-control command:
`SOUR:BB:WIM:FRAM:TIME MS4`

User Frame Duration

Sets the frame duration for selection **User**. The values are freely selectable.

Remote-control command:
`SOUR:BB:WIM:FRAM:TIME:USER 0.0043`

Downlink Subframe Duration (TDD, uplink only)

Delays the first uplink burst by the set time duration.

This feature can be used in TDD mode when combining downlink and uplink signals of two basebands. Either the same external trigger signal for both basebands, or trigger baseband B with baseband A can be used. The **Downlink Subframe Duration** has to be set to at least the duration of the active downlink bursts of the other baseband to avoid overlapping of the combined downlink and uplink signals.
In FDD mode, this parameter is provided for convenience to enable a constant delay of the signal with respect to an internal or external frame trigger.

Remote-control command:
`SOUR:BB:WIM:SUBF:TIME 0.1ms`

Initial Delay of Burst #1 (FDD uplink only)

Delays the first uplink burst by the set time duration.

In FDD mode, this parameter is provided for convenience to enable a constant delay of the signal with respect to an internal or external frame trigger.

Remote-control command:
`SOUR:BB:WIM:FRAM:BURS:DEL 0.1`

Sequence Length

Sets the sequence length of the signal in number of frames. The signal is calculated in advance and output in the arbitrary waveform generator. Burst data sources are continuously read over the whole sequence length.

Remote-control command:
`SOUR:BB:WIM:SLEN 20`

Predefined Frames

Selects the frame type.

Test Message BPSK 1/2 Short, Test Message BPSK 1/2 Mid, … (OFDM only)

Predefined setups for receiver test messages according to IEEE 802.16-2004 section 8.3.11

Remote-control command:
`SOUR:BB:WIM:OFDM:FRAM:PRED FBPSK12MID`

User

The settings for the frame can be defined by the user.

Remote-control command:
`SOUR:BB:WIM:OFDM:FRAM:PRED USER`
`SOUR:BB:WIM:AOFD:FRAM:PRED USER`

Level Reference Selects the level reference.

FCH / Burst (OFDM only) The instrument's level setting refers to the mean power of FCH (Frame Control Header) or bursts with a burst power setting of 0 dB.

To obtain the absolute burst power value, the burst power value has to be added to the level value.

Remote-control command:
`SOUR:BB:WIM:OFDM:POW:REF BURS`

Preamble (OFDM uplink and downlink; OFDMA downlink only) The instrument's level setting refers to the preamble, which is

FCH / Burst power + 3dB in OFDM mode.

Remote-control command:
`SOUR:BB:WIM:OFDM:POW:REF PRE`
`SOUR:BB:WIM:AOFD:POW:REF PRE`

Subframe RMS power (OFDMA only) The instrument's level setting refers to the rms power of the subframe. This includes the preamble and all symbols with allocated carriers in downlink or the whole uplink subframe in uplink.

Remote-control command:
`SOUR:BB:WIM:AOFD:POW:REF PRE`

Frame Configuration... Calls the menu for configuration of the frame.
The menu is described separately for the two physical layer mode.

Remote-control command: n.a.

Filter, Clipping, ... Calls the menu for setting clipping and the sample rate variation of the arbitrary waveform. The current setting is displayed next to the button.

Remote-control command: n.a.

Trigger / Marker... Calls the menu for selecting the trigger source, for configuring the marker signals and for setting the time delay of an external trigger signal.
The currently selected trigger source is displayed to the right of the button.

Remote-control command: n.a.

Execute Trigger (Trigger Source Internal only) Executes trigger manually.
A manual trigger can be executed only when an internal trigger source and a trigger mode other than **Auto** have been selected.

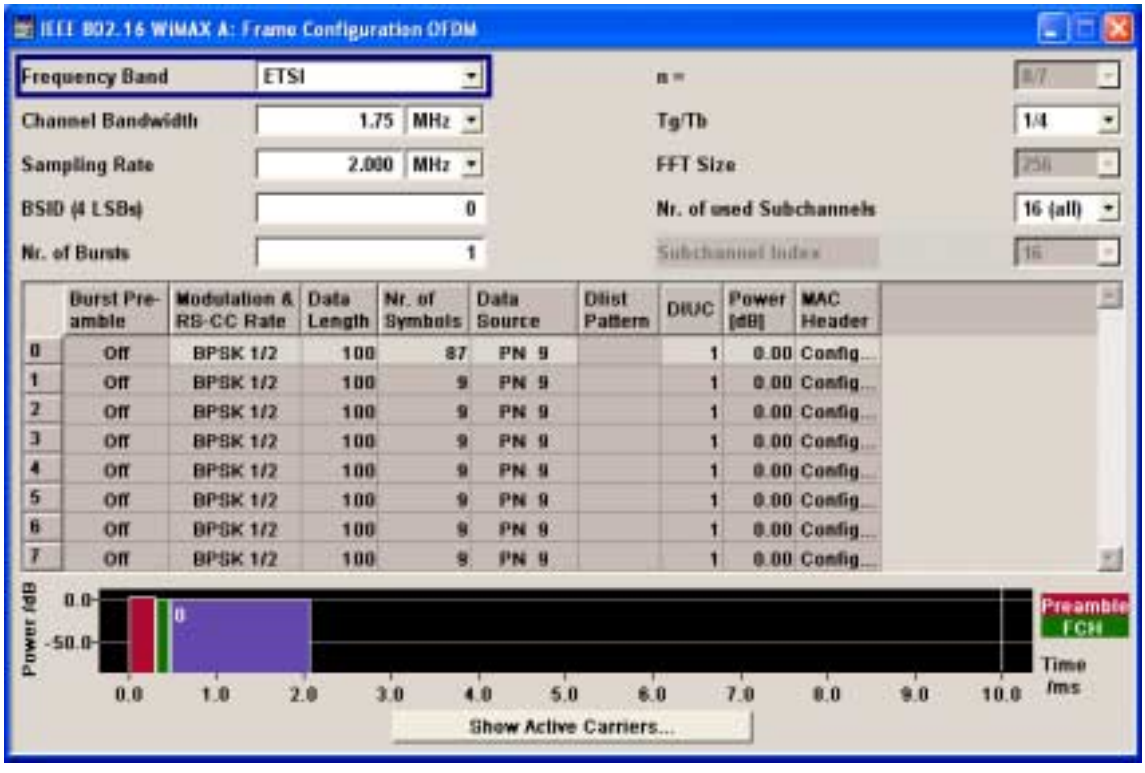
Remote-control commands:
`SOUR:BB:WIM:TRIG:SOUR INT`
`SOUR:BB:WIM:SEQ RETR`
`SOUR:BB:WIM:TRIG:EXEC`

Clock... Calls the menu for selecting the clock source and for setting a delay.

Remote-control command: `n.a.`

Frame Configuration OFDM - WiMAX

This menu provides all parameters to configure frames in OFDM mode. The menu differs depending on the selected link direction. The following graphh shows the menu for downlink direction.



Frequency Band Selects the frequency band for the carrier frequencies. The available ranges for setting the channel bandwidth and the sampling rate depend on the selection here.

ETSI The frequency band as defined by the **European Telecommunications Standards Institute** applies.

The range is 1.75 to 28 MHz for the channel bandwidth and 2 to 32 MHz for the sampling rate.

Remote-control command:
`SOUR:BB:WIM:OFDM:FBAN ETSI`

MMDS The frequency band as defined by the **Multichannel Multipoint Distribution Service** applies. The RF frequency range is 2500 to 2686 MHz.

The range is 1.50 to 24 MHz for the channel bandwidth and 1.72 to 27.52 MHz for the sampling rate.

Remote-control command:
`SOUR:BB:WIM:OFDM:FBAN MMDS`

WCS

The frequency band as defined by the **Wireless Communication Service** applies. It is in the 2.3 GHz band of the electromagnetic spectrum from 2305 to 2320 MHz and 2345 to 2360 MHz.

The range is 2.5 to 15 MHz for the channel bandwidth and 2.88 to 17.28 MHz for the sampling rate.

Remote-control command:
`SOUR:BB:WIM:OFDM:FBAN WCS`

U-NII

The frequency band as defined by the **Unlicensed National Information Infrastructure** applies. It is in the 5 GHz band of the electromagnetic spectrum from 5150 to 5350 GHz and 5750 to 5825 GHz.

The range is 10 to 20 MHz for the channel bandwidth and 11.52 to 23.04 MHz for the sampling rate.

Remote-control command:
`SOUR:BB:WIM:OFDM:FBAN UNII`

User

This mode is provided for choosing any other channel bandwidth / sampling rate combination. The range is 1.25 to 28 MHz for the channel bandwidth and 1.44 to 32 MHz for the sampling rate.

Remote-control command:
`SOUR:BB:WIM:OFDM:FBAN USER`

Channel Bandwidth

Sets the channel bandwidth. The range is 1.25 to 28 MHz.

The selected channel bandwidth has to be a multiple of 1.25, 1.5, 1.75, 2.0 or 2.75 MHz. The channel bandwidth determines the parameter n (sampling ratio, see below):
For channel bandwidths
that are a multiple of 1.75 MHz then n = 8/7
that are a multiple of 1.5 MHz then n = 86/75
that are a multiple of 1.25 MHz then n = 144/125
that are a multiple of 2.75 MHz then n = 316/275
that are a multiple of 2.0 MHz then n = 57/50
else for channel bandwidths not otherwise specified then n = 8/7

The sampling rate is derived from the channel bandwidth as follows:

SamplingRate = floor(n * ChannelBandwidth / 8000) * 8000

Remote-control command:
`SOUR:BB:WIM:OFDM:BW 14 MHz`

n

Indicates the sampling ratio. The sampling ratio is determined by the channel bandwidth (see above, parameter **Channel Bandwidth**)

Remote-control command:
`SOUR:BB:WIM:OFDM:N?`

Sampling Rate

Sets the sampling rate. The possible settings depend on the selected frequency band. The full range in **User** mode is 1.44 to 32 MHz.

The sampling rate is related to the channel bandwidth by the parameter n:

SamplingRate = floor(n * ChannelBandwidth / 8000) * 8000

Remote-control command:
`SOUR:BB:WIM:OFDM:SRAT 2 MHz`

BSID (4 LSBs)

Sets the 4 LSBs of the Base Station ID.
The BSID is transmitted in the FCH (when set to **Auto** mode), and it is used to initialize the randomizer.

Remote-control command:
`SOUR:BB:WIM:OFDM:BSID 4`

No. of Bursts

Sets the number of active bursts in one frame.
With number of bursts = 0, a preamble only or a preamble with an FCH burst is generated.

Remote-control command:
`SOUR:BB:WIM:OFDM:BURS:COUN 2`

Tg/Tb

Selects the ratio of guard period to symbol period.
This value sets the length of the cyclic prefix in fractions of the symbol period.

Remote-control command:
`SOUR:BB:WIM:OFDM:TGTB TGTB1D16`

No. of used Subchannels

Selects the number of used subchannels.
Selection 16 (all) deactivates subchannelization and activates all possible carriers. The values 1, 2, 4 and 8 activate only a part of the available subcarriers, unused carriers are blanked.

Remote-control command:
`SOUR:BB:WIM:OFDM:SUBC:COUN SC2`

Subchannel Index

Selects the subchannel index in subchannelization mode.
The subchannel index determines the set of used subcarriers according to table 213 of IEEE 802.16-2004 standard.

Remote-control command:
`SOUR:BB:WIM:OFDM:SUBC:IND SUBC4`

Frame/Burst Preamble

Activates/deactivates the generation of a downlink frame preamble or an uplink burst preamble. Either a long preamble or a short preamble can be activated.
The 802.16 standard requires a long preamble as frame start in the downlink.

Remote-control command:
`SOUR:BB:WIM:OFDM:PRE:MODE LONG`

Frame Number (uplink only)

Selects the frame number of the uplink frame in which the UL map that specifies the uplink burst was transmitted.

Remote-control command:
`SOUR:BB:WIM:OFDM:FRAM:NUMB 13`

Configure FCH (downlink only)

Calls the menu for configuring FCH mode and parameters (see section "*FCH Configuration Downlink OFDM- WiMAX*", page 16).

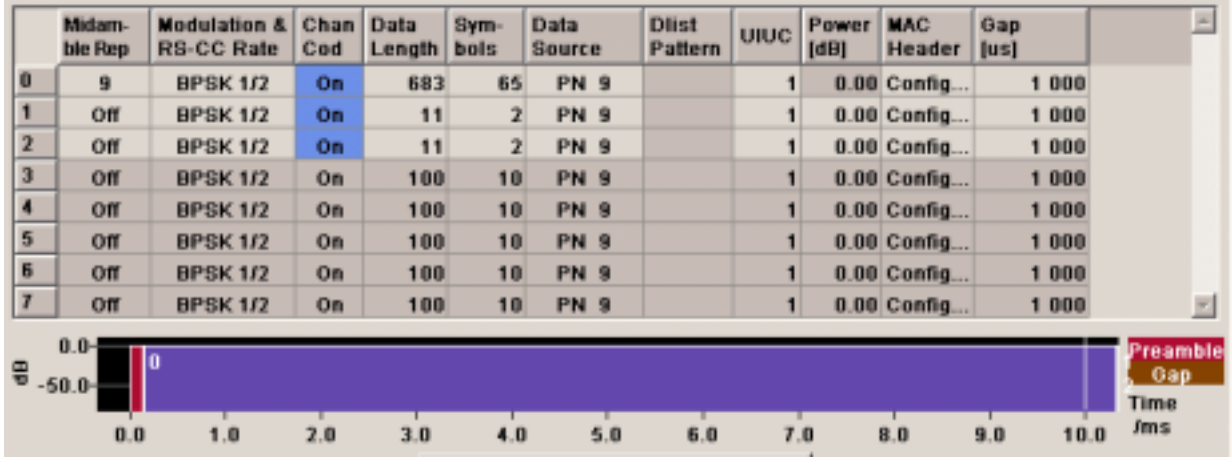
Remote-control command: n.a.

Burst Table OFDM- WiMAX

The **burst table** is located in the lower part of the menu. The burst table is where the individual burst parameters are set. A graphic display below the table shows length, position and power of all configured bursts within the frame.

Up to 8 bursts can be configured per frame. Each table row defines the settings of one specific burst, where the first row defines the first burst of the frame and the last row defines the last burst.

For both transmission directions, different modulations and channel coding rates are available for each burst. A generic MAC header with encrypted payload and checksum determination can be activated. Some setting parameters differ for the two transmission directions. The graph below shows the table in uplink direction.



Burst Index

Displays the consecutive burst index from 0 to 7.
All the rows are always displayed, even if the bursts are inactive. They are switched on and off by the selection of **No. of Bursts** above the table. The active bursts are highlighted.

Remote-control command: n.a.
(selected via the suffix to the keyword `:BURSt<n>`)

Burst Preamble (Downlink only)

Enables generation of the burst preamble in downlink.
If activated, a short preamble of one symbol length is placed before the burst. The preamble has the same power as the burst. If subchannelization is used, a subchannelization preamble is generated accordingly.

Remote-control command:
`SOUR:BB:WIM:OFDM:BURS2:PRE:STAT ON`

Midamble Repetition (Uplink only)

Activates/deactivates midamble repetition.
If midamble repetition is switched on, midambles are placed into the burst with the specified interval, i.e. if 5 is selected, every 5th symbol of the burst is a midamble.
The midambles are identical to the burst preamble, that means a short preamble is used as midamble when subchannelization is off or a subchannelization preamble is used in subchannelization mode. The uplink burst preamble is always generated, even if midambles are switched off. The power of the midambles is identical to the burst power.

Remote-control command:
`SOUR:BB:WIM:OFDM:BURS2:MID REP5`

Modulation and RS-CC Rate

Selects the modulation and channel coding rate. Channel coding includes randomization, reed solomoon coding, convolutional coding and interleaving.

For a given modulation type and channel coding rate, the data length determines the number of symbols and vice versa.

Remote-control command:
`SOUR:BB:WIM:OFDM:BURS:FORM QPSK3D4`

Channel Coding

Switches channel coding on or off.

If channel coding is switched off, the bits read from the data source are directly modulated onto the carriers. Due to randomization missing, this could result in very high crest factors of the signal.

Remote-control command:
`SOUR:BB:WIM:OFDM:BURS:CCOD:STAT ON`

Data Length

Determines the data length in bytes.

The given number of bytes is read from the data source. The total number of data bytes in the burst (before channel coding) is determined as follows:

TotalDataBytes = DataLength + MACHeaderBytes + CRCBytes + TailByte

The tail byte is only added when channel coding is switched on. The same is the case for the MAC header and CRC, they are not added when switched off. Additionally padding with 0xFF bytes is applied at the end of the data sequence to reach an integer number of OFDM symbols.

The data length determines the number of symbols and vice versa. The maximum data length of 10000 bytes defines the maximum number of symbols for a given modulation type and channel coding rate.

Remote-control command::
`SOUR:BB:WIM:OFDM:BURS:DLEN 1000`

Number of Symbols

Enters the number of symbols for the selected burst. If the number of symbols is changed, the data length is adjusted to fill the specified number of symbols with data so that no padding has to be applied.

The maximum data length of 10 000 bytes defines the maximum number of symbols for a given modulation type and channel coding rate.

Remote-control command:
```
SOUR:BB:WIM:OFDM:BURS:SYMB:COUN 114
```

Data Source

Selects data source for the selected bursts.
The data sources **PN9**, **PN11, PN15**, **PN16**, **PN20**, **PN21**, **PN23**, **ALL 0**, **ALL1**, **Pattern** and **Data List** are all available to choose from.

Data lists can be generated internally in the data editor or externally. Data lists are selected in the **File Select** window, which is called by means of the **Data List Management** button.
If the **Pattern** data type is used, the bit pattern is defined in the **Pattern** input box. The length is limited to 64 bits.
If the **Ext USB** data type is used, the data must be supplied externally via the USB interface.

Remote-control command
```
SOUR:BB:WIM:OFDM:BURS2:DATA    PATT
SOUR:BB:WIM:OFDM:BURS2:DATA:PATT #H3F,8

SOUR:BB:WIM:OFDM:BURS2:DATA    DLIS
SOUR:BB:WIM:OFDM:BURS2:DATA:DSEL "BS2_OFDM"
```

DIUC (downlink)
UIUC (uplink)

Sets the specific interval usage code.
The code is used to initialize the randomizer. In the downlink, it is named DIUC and is transmitted in the FCH. In the uplink it is named UIUC.

Remote-control command:
```
SOUR:BB:WIM:OFDM:BURS2:DIUC 2
SOUR:BB:WIM:OFDM:BURS2:UIUC 2
```

Power/dB

Sets the burst power in dB.

To set the absolute power of a burst correctly, level reference "**FCH / Burst**" must be selected. In this mode, the output power of a burst equals Level + BurstPower.

In downlink, the preamble is transmitted with +3dB and the FCH is transmitted with 0dB.

In uplink, the power of the first burst is fixed to 0dB.

Remote-control command:
```
SOUR:BB:WIM:OFDM:BURS2:POW -20
```

MAC Header

Calls the menu for configuring the generic MAC (Media Access Control) header of the selected burst and for activating the checksum determination (see section "MAC Header Configuration - WiMAX", page 31).

Remote-control command: n.a.

Gap
(Uplink only)

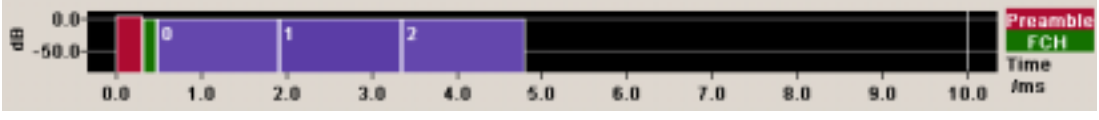
Sets the length of the gap between the selected burst and the next burst in µs. The setting is only available for transmission direction uplink.

Remote-control command:
`SOUR:BB:WIM:OFDM:BURS2:GAP 0.001`

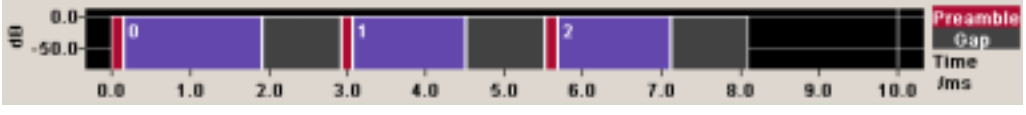
Frame Graph OFDM - WiMAX

The frame graph indicates the configuration of one frame. The scaling of the X-axis is always adapted to the set frame duration. The preamble length, FCH length and the burst length are drawn to scale. The relative power can be taken from the height of the bar. The power of the preamble is always +3 dB and of the FCH always 0 dB relative to the power of the other bursts.
The shown frame configuration is repeated over the whole sequence length.

In downlink direction the frame preamble is sent at the beginning of the frame.

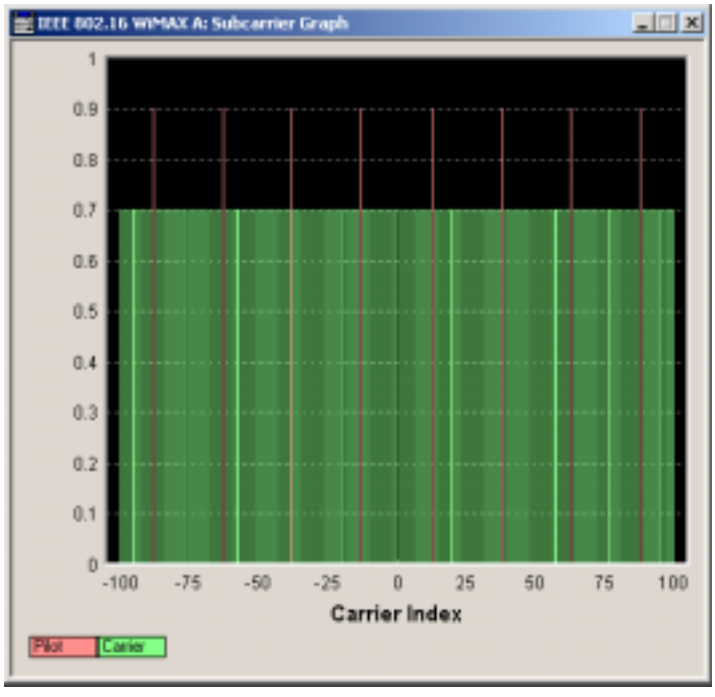


In uplink direction each burst starts with a preamble. The first gap at the beginning of the frame is determined by the Downlink Subframe Duration (specified in the main menu), the following gaps are defined by the gap value specified for the associated burst in the burst table.



Show Active Carriers OFDM - WiMAX

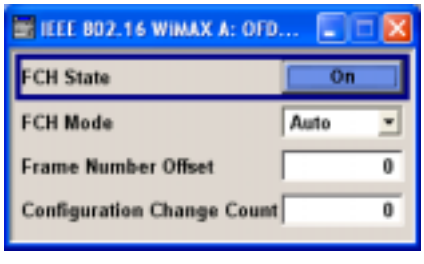
The Active Carrier graph is reached via the **Show Active Carrier...** button at the Bottom of the **Frame Configuration...** submenu.



The graph shows used pilots and carriers of the current subchannelization mode. When subchannelization is activated by setting **No. of used Subchannels** to a value different than 16, the graph shows the used and blanked carriers according to the setting of **Subchannel Index**.

FCH Configuration Downlink OFDM- WiMAX

The **FCH Configuration** menu is reached via the **Configure FCH..** button in the frame configuration menu. The FCH is only available in downlink mode. The following describes the FCH options in OFDM mode.



FCH State Switches the FCH on or off.

Remote-control command:
`SOUR:BB:WIM:OFDM:FCH:STAT ON`

FCH Mode

Selects the mode for generating the FCH.
Channel Coding of the FCH is performed both in **Auto** and **User** mode.

Auto In **Auto** mode, the DLFP (Downlink Frame Prefix) fields, which form the FCH, are filled automatically with parameters specified at different locations.
The following mapping applies in Auto mode:

Base_Station_ID:	Set to the BSID value specified in the frame configuration menu.
Frame_Number:	Set to the current frame number modulo 16. The first frame of the generated sequence has the number specified in Frame Number Offset below. For the following frames, this number will increase by 1 per frame.
Configuration_Change_Count:	Set to the value specified below.
Rate_ID:	The Rate ID parameter of the first burst is set according to its modulation setting.
DIUC:	The DIUC value for the second, third and fourth burst is taken from the DIUC value in the burst table.
Preamble Present:	Set to 1 when the burst preamble is activated for the corresponding burst.
Length:	Set to the calculated number of symbols of the corresponding burst.
HCS:	The Header Check Sequence is automatically calculated.

Remote-control command:
`SOUR:BB:WIM:OFDM:FCH:MODE AUTO`

User In **User** mode, the FCH is filled with data specified under Data Source. This enables any arbitrary data to be sent with the FCH burst.

Remote-control command:
`SOUR:BB:WIM:OFDM:FCH:MODE USER`

Frame Number Offset (Auto mode only)

Sets the frame number offset.
This value is added to the current frame number of the sequence. After modulo 16 division, the result is used as Frame_Number in the FCH (in Auto mode) and is also used to initialize the randomizers.

Remote-control command:
`SOUR:BB:WIM:OFDM:FCH:FNOF 14`

Configuration Change Count (Auto mode only)

Sets the configuration change count value.
This value is used for the corresponding FCH field in Auto mode.

Remote-control command:
`SOUR:BB:WIM:OFDM:FCH:CCC 14`

Data Source (User mode only)

Specifies the data source in User mode.
The FCH contents are filled from the selected data source.
The data sources **PN9**, **PN11, PN15**, **PN16**, **PN20**, **PN21**, **PN23**, **ALL 0**, **ALL1**, **Pattern** and **Data List** are all available to choose from.

Data lists can be generated internally in the data editor or externally. Data lists are selected in the **File Select** window, which is called by means of the **Data List Management** button.

If the **Pattern** data type is used, the bit pattern is defined in the **Pattern** input box. The length is limited to 64 bits.

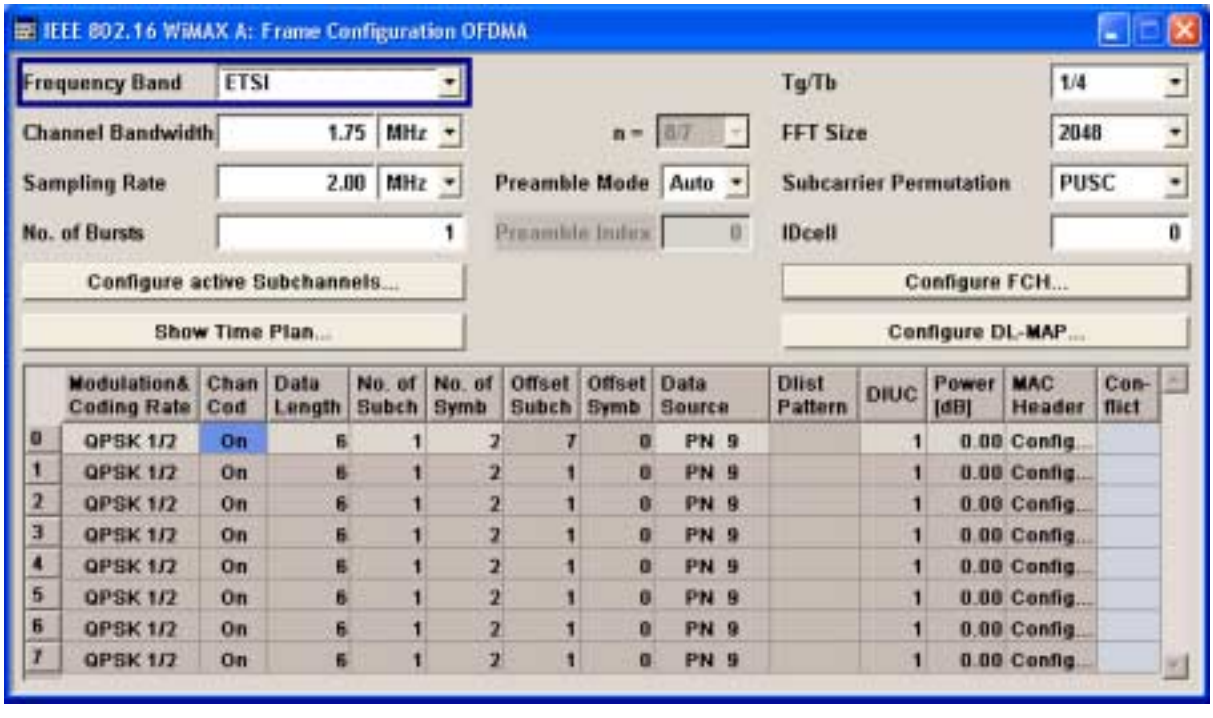
Remote-control command:

```
SOUR:BB:WIM:OFDM:FCH:DATA PATT
SOUR:BB:WIM:OFDM:FCH:DATA:PATT  #H3F,8

SOUR:BB:WIM:OFDM:FCH:DATA   DLIS
SOUR:BB:WIM:OFDM:FCH:DATA:DSEL "FCH"
```

Frame Configuration OFDMA - WiMAX

This menu provides all parameters to configure frames in OFDMA mode.



Frequency Band

Selects the frequency band for the carrier frequencies. The available ranges for setting the channel bandwidth and the sampling rate depend on the selection here.

ETSI

The frequency band as defined by the **European Telecommunications Standards Institute** applies.

The range is 1.75 to 28 MHz for the channel bandwidth and 2 to 32 MHz for the sampling rate.

Remote-control command:
`SOUR:BB:WIM:AOFD:FBAN ETSI`

MMDS

The frequency band as defined by the **Multichannel Multipoint Distribution Service** applies. The RF frequency range is 2500 to 2686 MHz.

The range is 1.50 to 24 MHz for the channel bandwidth and 1.68 to 26.88 MHz for the sampling rate.

Remote-control command:
`SOUR:BB:WIM:AOFD:FBAN MMDS`

WCS

The frequency band as defined by the **Wireless Communication Service** applies. It is in the 2.3 GHz band of the electromagnetic spectrum from 2305 to 2320 MHz and 2345 to 2360 MHz.

The range is 2.5 to 15 MHz for the channel bandwidth and 2.8 to 16.8 MHz for the sampling rate.

Remote-control command:
`SOUR:BB:WIM:AOFD:FBAN WCS`

U-NII

The frequency band as defined by the **Unlicensed National Information Infrastructure** applies. It is in the 5 GHz band of the electromagnetic spectrum from 5150 to 5350 GHz and 5750 to 5825 GHz.

The range is 10 to 20 MHz for the channel bandwidth and 11.2 to 22 MHz for the sampling rate.

Remote-control command:
`SOUR:BB:WIM:AOFD:FBAN UNII`

User

This mode is provided for choosing any other channel bandwidth / sampling rate combination. The range is 1.25 to 28 MHz for the channel bandwidth and 1.4 to 32 MHz for the sampling rate.

Remote-control command:
`SOUR:BB:WIM:AOFD:FBAN USER`

Channel Bandwidth

Sets the channel bandwidth. The range is 1.25 to 28 MHz.

The selected channel bandwidth has to be a multiple of 1.25, 1.5, 1.75, 2.0 or 2.75 MHz. The channel bandwidth determines the parameter n (sampling ratio, see below):
For channel bandwidths
that are a multiple of 1.75 MHz then n = 8/7
that are a multiple of 1.5 MHz then n = 28/25
that are a multiple of 1.25 MHz then n = 28/25
that are a multiple of 2.75 MHz then n = 28/25
that are a multiple of 2.0 MHz then n = 28/25
else for channel bandwidths not otherwise specified then n = 8/7

The sampling rate is derived from the channel bandwidth as follows:

SamplingRate = floor(n * ChannelBandwidth / 8000) * 8000

Remote-control command:
`SOUR:BB:WIM:AOFD:BW 14 MHz`

n

Indicates the sampling ratio. The sampling ratio is determined by the channel bandwidth (see above, parameter **Channel Bandwidth**)

Remote-control command:
`SOUR:BB:WIM:AOFD:N?`

Sampling Rate

Sets the sampling rate. The possible settings depend on the selected frequency band. The full range in **User** mode is 1.44 to 32 MHz.

The sampling rate is related to the channel bandwidth by the parameter n:

SamplingRate = floor(n * ChannelBandwidth / 8000) * 8000

Remote-control command:
`SOUR:BB:WIM:AOFD:SRAT 2 MHz`

No. of Bursts

Sets the number of active bursts in one frame.
With number of bursts = 0, a preamble only or a preamble with an FCH and/or DL-MAP is generated in downlink mode.

Remote-control command:
`SOUR:BB:WIM:AOFD:BURS:COUN 2`

Tg/Tb

Selects the ratio of guard period to symbol period.
This value sets the length of the cyclic prefix in fractions of the symbol period.

Remote-control command:
`SOUR:BB:WIM:AOFD:TGTB TGTB1D16`

FFT Size

Selects the FFT size.

Remote-control command:
`SOUR:BB:WIM:AOFD:FFT 2048`

Subcarrier Permutation

Selects the type of subcarrier permutation for OFDMA configurations.

Remote-control command:
`SOUR:BB:WIM:AOFD:SCAR:PERM PUSC`

UL_PermBase (uplink only)

IDcell (downlink only)

Sets the IDcell and PermBase parameters used in the permutation equations. In the first downlink zone, IDcell is used as DL_PermBase parameter for the permutation equations and partly sets the subcarrier randomizer initialisation vector. In the uplink, UL_PermBase is used in the permutation equation and is mapped to the preamble IDcell parameter for the subcarrier randomizer initialisation vector.

Remote-control command:
`SOUR:BB:WIM:AOFD:IDC 4`
`SOUR:BB:WIM:AOFD:ULID 4`

No. of Symbols in UL Zone (uplink only)

Sets the length of the uplink zone in symbols. The duration of uplink bursts can not exceed the specified number of symbols.

Remote-control command:
`SOUR:BB:WIM:AOFD:ULZ:SYMB:COUN 4`

Preamble Mode (downlink only)

Selects the mode for selecting the preamble index.

Auto

The preamble index value is automatically derived from the used segment (see "*Configure active Subchannels OFDMA - WiMAX*") and the IDcell parameter. The Preamble Index field below shows the used preamble index.

Remote-control command:
`SOUR:BB:WIM:AOFD:PRE:IND:MODE AUTO`

User

Sets the preamble index to one of the available indices from 1 to 113 specified in the **Preamble Index** field.

Remote-control command:
`SOUR:BB:WIM:AOFD:PRE:IND:MODE USER`

Preamble Index (downlink only)

Sets the preamble index to one of the available indices from 1 to 113 in preamble mode "user".

Remote-control command:
`SOUR:BB:WIM:AOFD:PRE:IND 12`

Configure active Subchannel

Calls the menu for activating/deactivating subchannels.

Use all Subchannels

Activates the generation of all subchannels.
The used downlink segment is derived from the selection made here as follows:
If subchannel group 0 (subchannels 0-11 with FFT Size 2048) is active, the segment is 0.
If subchannel group 0 is inactive and subchannel group 2 (subchannels 20-31 with FFT Size 2048) is active, the segment is 1.
If subchannel group 0 and 2 are inactive and subchannel group 4 (subchannels 40-51 with FFT Size 2048) is active, the segment is 2.
If subchannel group 0, 2 and 4 are inactive, the segment is 0.
Only one segment can be activated per downlink PUSC zone at this time. The segment number defined by the subchannel selection sets the location of the FCH and the preamble index in preamble index “auto” mode. Additionally, the subcarrier randomizer initialization vector is affected by the segment number.

Remote-control command:
`SOUR:BB:WIM:AOFD:SUBC:MODE ALL`

Use Subchannels x...y (downlink PUSC only)

Activates the generation of the selected group(s) of subchannels.

Remote-control command:
```
SOUR:BB:WIM:AOFD:SUBC:MODE USER
SOUR:BB:WIM:AOFD:SUBC2:MAP ON
SOUR:BB:WIM:AOFD:SUBC3:MAP ON
```

Allocated Subchannels Bitmap (uplink only)

In uplink mode, each physical subchannel can be individually activated or deactivated. This is realized with a 9 byte field identical to the UL allocated subchannels bitmap in the UCD message. The bytes of the bitmap are read from left to right and specify the physical subchannels in LSB first order. The LSB of the first (most left) byte selects the physical subchannel 0.
The same order applies for all FFT Sizes.
Subchannel bitmap bits that are not needed in modes with less than 70 physical subchannels are discarded.

Remote-control command:
```
SOUR:BB:WIM:AOFD:SUBC:PATT
#HFFFFFFFFFFFFFFFF3F,72
```

Configure FCH (downlink only)

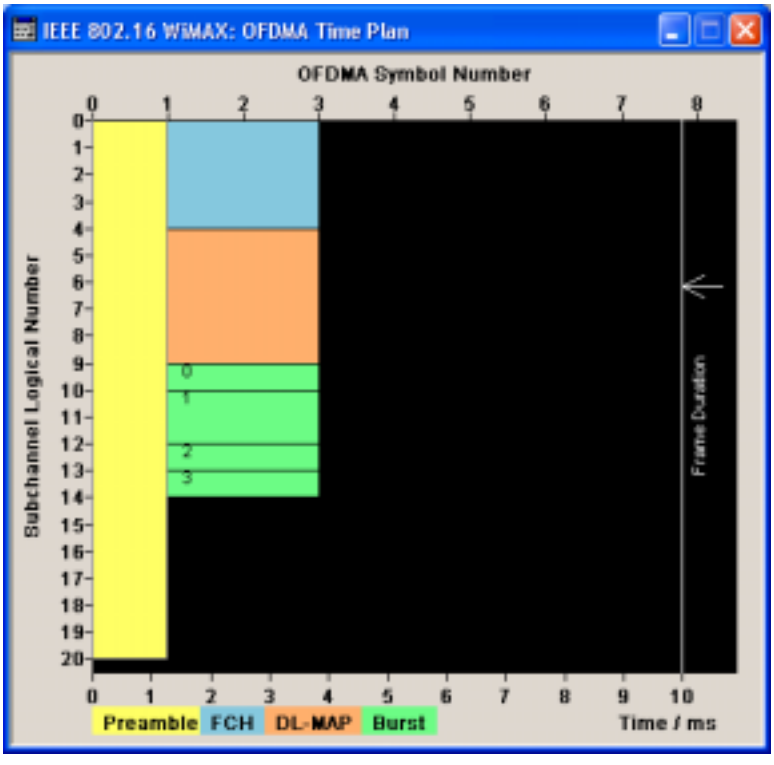
Calls the menu for configuring FCH mode and parameters (see section "*FCH Configuration Downlink OFDMA - WiMAX*", on page "27").

Remote-control command: n.a.

Show Time Plan

Calls the graphical display of the OFDMA Time Plan.

Remote-control command: n.a.



The frame graph indicates the assignment of the active bursts.
The x-axis shows the OFDMA symbol number relative to zone start on the top of the diagram and the time in ms relative to frame start on the bottom of the diagram. The vertical line on the right side shows the frame boundary.
The y-axis indicates the logical numbers of the activated subchannels.
In the graph above, four bursts with a length of either one (bursts 0, 2 and 3) or two subchannels are indicated. The number of symbols is 2 for each burst, no offset is set. Subchannels 0 to 19, FCH and DL-Map are activated.

Configure DL-MAP (downlink only)

Calls the menu for configuring the DL-MAP (see section "*DL-MAP Configuration Downlink OFDMA - WiMAX*", page 28).

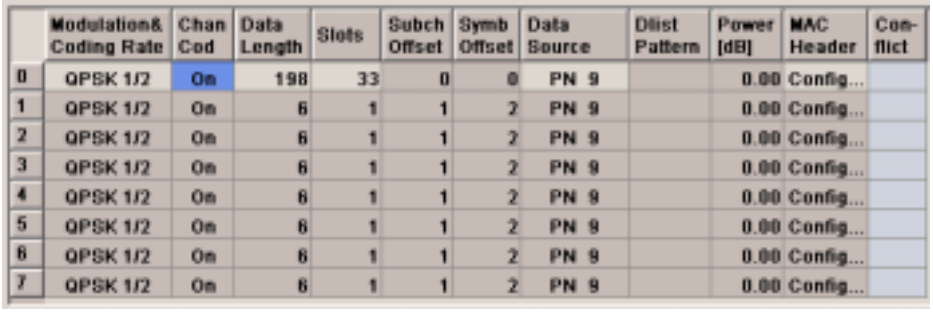
Remote-control command: n.a.

Burst Table OFDMA - WiMAX

The **burst table** is located in the lower part of the menu where individual burst parameters are set. A graphic display of the current burst locations in time and subchannel space can be viewed with the **Show Time Plan** button.

Each frame supports up to 8 bursts with individual parameters. For both transmission directions, different modulations and channel coding rates are available. For each burst, an optional generic MAC header and CRC is provided.

Burst table in uplink



	Modulation& Coding Rate	Chan Cod	Data Length	Slots	Subch Offset	Symb Offset	Data Source	Dlist Pattern	Power [dB]	MAC Header	Con-flict
0	QPSK 1/2	On	198	33	0	0	PN 9		0.00	Config...	
1	QPSK 1/2	On	6	1	1	2	PN 9		0.00	Config...	
2	QPSK 1/2	On	6	1	1	2	PN 9		0.00	Config...	
3	QPSK 1/2	On	6	1	1	2	PN 9		0.00	Config...	
4	QPSK 1/2	On	6	1	1	2	PN 9		0.00	Config...	
5	QPSK 1/2	On	6	1	1	2	PN 9		0.00	Config...	
6	QPSK 1/2	On	6	1	1	2	PN 9		0.00	Config...	
7	QPSK 1/2	On	6	1	1	2	PN 9		0.00	Config...	

Burst Index

Displays the consecutive burst index from 0 to 7.
All the rows are always displayed, even if the bursts are inactive. They are switched on and off by the selection of **No. of Bursts** above the table. The active bursts are highlighted.

Remote-control command: n.a.
(selected via the suffix to the keyword `:BURSt<n>`)

Modulation and Coding Rate

Selects the modulation and channel coding rate. Channel coding includes randomization, convolutional coding and interleaving.

Remote-control command:
`SOUR:BB:WIM:AOFD:BURS2:FORM QPSK1D2`

Channel Coding

Switches channel coding on or off.

If channel coding is switched off, the bits read from the data source are directly modulated onto the carriers. Due to missing randomization, this could result in very high crest factors of the signal.

Remote-control command:
`SOUR:BB:WIM:AOFD:BURS:CCOD:STAT ON`

Data Length

Determines the data length in bytes.

The given number of bytes is read from the data source. The total number of data bytes in the burst (before channel coding) is determined as follows:

TotalDataBytes = DataLength + MACHeaderBytes + CRCBytes

Additionally padding with 0xFF bytes is applied at the end of the data sequence to fill up the allocated slots specified by “No. of Subch” and **No. of Symb** in downlink mode and **Duration [Slots]** in uplink mode. Thus, the Data Length can be lower than the burst’s allocated number of bytes.

Up to 10 000 data bytes can be set for each burst.

Remote-control command::
`SOUR:BB:WIM:AOFD:BURS:DLEN 1000`

Number of Subchannels (Downlink only)

Enters the number of subchannels for the selected burst. If the number of subchannels is changed, the data length is adjusted to fill the allocated space defined by **No. of Subch** and **No. of Symb** with data so that no padding has to be applied. The data length can be lowered afterwards if data bytes less than the allocated number shall be read from the data source.

Remote-control command:
`SOUR:BB:WIM:AOFD:BURS:SUBC:COUN 114`

Number of Symbols (Downlink only)

Enters the number of symbols for the selected burst.
If the number of symbols is changed, the data length is adjusted to fill the allocated space defined by **No. of Subch** and **No. of Symb** with data so that no padding has to be applied. The data length can be decreased afterwards if data bytes less than the allocated number shall be read from the data source. The entered number of symbols is automatically adjusted to a multiple of the number of symbols per slot for the set subcarrier permutation.

Remote-control command:
`SOUR:BB:WIM:AOFD:BURS:SYMB:COUN 14`

Duration [Slots] (uplink only)

Enters the number of slots for the selected burst. If the number of slots is changed, the data length is adjusted to fill the specified number of slots with data so that no padding has to be applied.

Remote-control command:
`SOUR:BB:WIM:AOFD:BURS:SLOT:COUN 114`

Offset Subchannel

Indicates the subchannel offset for the selected burst. This value can be modified after **Auto Offset** is deactivated:

A submenu opens after setting the entry focus on the table cell and pressing the **Enter** key.

After **Auto Offset** is deactivated the value **Subchannel Offset** can be modified.

It is possible that bursts overlap in manual offset mode. The **Conflict** column indicates overlapping bursts.

Remote-control command:
```
SOUR:BB:WIM:AOFD:BURS:OFFS:MODE USER
SOUR:BB:WIM:AOFD:BURS:OFFS:SUBC  7
```

Offset Symbol

Indicates the symbol offset for the selected burst. The symbol offset is specified relative to zone start. In the first downlink zone, symbol offset 0 refers to the first symbol after the preamble.

This value can be modified after **Auto Offset** is deactivated:

A submenu opens after setting the entry focus on the table cell and pressing the **Enter** key.

After **Auto Offset** is deactivated the value **Symbol Offset** can be modified. The set symbol offset is rounded to a multiple of the number of symbols per slot defined by the set subcarrier permutation.

It is possible that bursts overlap in manual offset mode. The **Conflict** column indicates overlapping bursts.

Remote-control command:
```
SOUR:BB:WIM:AOFD:BURS:OFFS:MODE USER
SOUR:BB:WIM:AOFD:BURS:OFFS:SYMB 2
```

Data Source

Selects data source for the selected bursts.
The data sources **PN9**, **PN11, PN15**, **PN16**, **PN20**, **PN21**, **PN23**, **ALL 0**, **ALL1**, **Pattern** and **Data List** are all available to choose from.

Data lists can be generated internally in the data editor or externally. Data lists are selected in the **File Select** window, which is called by means of the **Data List Management** button.

If the **Pattern** data type is used, the bit pattern is defined in the **Pattern** input box. The length is limited to 64 bits.

If the **Ext USB** data type is used, the data must be supplied externally via the USB interface.

Remote-control command
```
SOUR:BB:WIM:AOFD:BURS2:DATA    PATT
SOUR:BB:WIM:AOFD:BURS2:DATA:PATT #H3F,8

SOUR:BB:WIM:AOFD:BURS2:DATA    DLIS
SOUR:BB:WIM:AOFD:BURS2:DATA:DSEL "BS2_AOFD"
```

DIUC (downlink)

Sets the specific DIUC. In DL-MAP mode **Auto**, the DIUC of each burst is included in the DL-MAP.

Remote-control command:
```
SOUR:BB:WIM:AOFD:BURS2:DIUC 2
```

Power/dB

Sets the burst power in dB. T

his setting affects the data tones only in downlink mode, the pilot power is fixed. In uplink, the setting affects both data and pilot tones.

Remote-control command:
```
SOUR:BB:WIM:AOFD:BURS2:POW -20
```

MAC Header

Calls the menu for configuring the generic MAC (Media Access Control) header of the selected burst and for activating the checksum determination (see section "*MAC Header Configuration - WiMAX*", page 31).

Remote-control command: n.a.

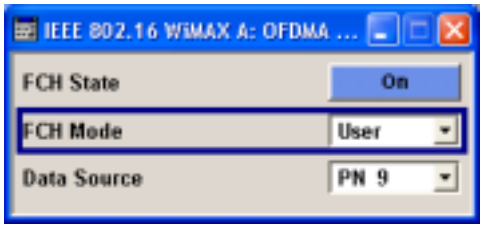
Conflict

Indicates a conflict between the settings of the bursts.
Conflicts can occur if subchannel and symbol offsets are set manually and two or more bursts overlap. Bursts can also overlap with the FCH or DL-MAP. The position of FCH and DL-MAP is fixed and cannot be changed.

Remote-control command:
`SOUR:BB:WIM:AOFD:BURS2:CONF:STAT?`

FCH Configuration Downlink OFDMA - WiMAX

The **FCH Configuration** menu is reached via the **Configure FCH..** button in the frame configuration menu. The FCH is only available in downlink mode. The following describes the FCH options in OFDMA mode.



FCH State

Switches the FCH on or off.

Remote-control command:
`SOUR:BB:WIM:AOFD:FCH:STAT ON`

FCH Mode

Selects the mode for generating the FCH.
Channel Coding of the FCH is performed both in **Auto** and **User** mode.

Auto

In **Auto** mode, the DLFP (Downlink Frame Prefix) fields, which form the FCH, are filled automatically with parameters specified at different locations.
The following mapping applies in Auto mode:

Used subchannel bitmap:
Set to the bitmap specified in the "Configure active Subchannels" panel.
Repetition_Coding_Indication:
Specifies the DL-MAP repetition coding set in the "Configure DL-MAP" panel.
Coding_Indication: Set to 0 to specify convolutional coding of the DL-MAP
DL-Map_Length: Set to the number of slots allocated for the DL-MAP.

The FCH is transmitted with QPSK 1/2 and repetition coding of 4. For FFT Size 128 a reduced FCH is transmitted in one slot.

Remote-control command:
`SOUR:BB:WIM:AOFD:FCH:MODE AUTO`

User In **User** mode, the FCH is filled with data specified under Data Source. This enables any arbitrary data to be sent with the FCH burst. 24 bits are read from the data source, these bits are repeated once to form 48 bits. The FCH is transmitted with QPSK 1/2 and repetition coding of 4. For FFT Size 128 a reduced FCH of size 12 bits is transmitted in one slot.

Remote-control command:
`SOUR:BB:WIM:AOFD:FCH:MODE USER`

Data Source (User mode only)

Specifies the data source in User mode.
The FCH contents are filled from the selected data source.
The data sources **PN9**, **PN11, PN15**, **PN16**, **PN20**, **PN21**, **PN23**, **ALL 0**, **ALL1**, **Pattern** and **Data List** are all available to choose from.

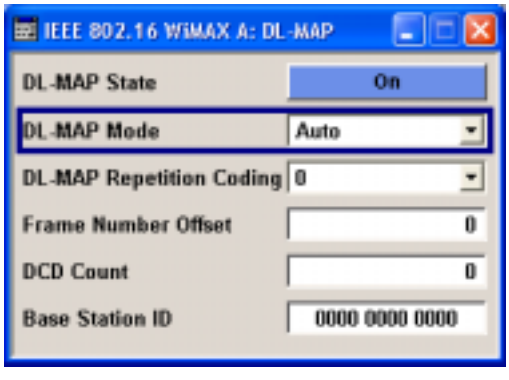
Data lists can be generated internally in the data editor or externally. Data lists are selected in the **File Select** window, which is called by means of the **Data List Management** button.

If the **Pattern** data type is used, the bit pattern is defined in the **Pattern** input box. The length is limited to 64 bits.

Remote-control command:
```
SOUR:BB:WIM:AOFD:FCH:DATA PATT
SOUR:BB:WIM:AOFD:FCH:DATA:PATT  #H3F,8
SOUR:BB:WIM:AOFD:FCH:DATA   DLIS
SOUR:BB:WIM:AOFD:FCH:DATA:DSEL "FCH"
```

DL-MAP Configuration Downlink OFDMA - WiMAX

The DL-MAP **Configuration** menu is reached via the **Configure DL-MAP...** button in the frame configuration menu. The DL-MAP is only available in OFDMA downlink mode.



DL-MAP State Switches the DL-MAP on or off.

Remote-control command:
`SOUR:BB:WIM:AOFD:DLM:STAT`

DL-MAP Mode

Selects the mode for generating the DL-MAP.
Channel Coding of the DL-MAP is performed both in **Auto** and **User** mode.

Auto

In **Auto** mode, the DL-MAP is filled automatically with parameters specified at different locations.
The following mapping applies in Auto mode:

Frame Duration Code:
Specified by the Frame Duration set in the WiMAX main panel.

Frame Number:
Starts with the value specified by "Frame Number Offset" in the first generated frame and advances by 1 in every following frame.

DCD Count:
Directly set by the "DCD Count" field.

Base Station ID:
48 bits specified by the "Base Station ID" field.

For each burst:

DIUC:
Set by the "DIUC" field in the burst table.

OFDMA Symbol offset:
Set to "Offset Symb" +1.

Subchannel offset:
Set to "Offset Subch" of the burst table.

Boosting:
Depends on the "Power" setting of the corresponding burst. The following mapping applies:
000: 0dB
001: +6dB
010: -6dB
011: +9dB
100: +3dB
101: -3dB
110: -9dB
111: -12dB
000 is set if any other value is specifed for "Power".

No. OFDMA Symbols:
Set to "No. of Symb" of the burst table.

No. Subchannels:
Set to "No. of Subch" of the burst table.

Repetition Coding Indication:
Set to 0.

Remote-control command:
`SOUR:BB:WIM:AOFD:DLM:MODE AUTO`

User

In **User** mode, the DL-MAP is filled with data specified under Data Source. This enables any arbitrary data to be sent with the DL-MAP burst.

Remote-control command:
`SOUR:BB:WIM:AOFD:DLM:MODE USER`

DL-MAP Repetition Coding

Repetition coding can be activated for the DL-MAP by specifying any value other than 0.

Remote-control command:
`SOUR:BB:WIM:AOFD:DLM:REPC RC0`

Frame Number Offset (Auto mode only)

Sets the frame number offset.
This value is added to the current frame number of the sequence. The result is used as Frame Number in the DL-MAP (in Auto mode).

Remote-control command:
`SOUR:BB:WIM:AOFD:DLM:FNOF 556`

DCD Count (Auto mode only)

Sets the DCD count value.
This value is used for the corresponding DL-MAP field in Auto mode.

Remote-control command:
`SOUR:BB:WIM:AOFD:DLM:DCD:COUN 12`

Base Station ID (Auto mode only)

Sets the Base Station ID.
This value is used for the corresponding DL-MAP field in Auto mode.

Remote-control command:
`SOUR:BB:WIM:AOFD:DLM:BSID #H2322222222FF,48`

Data Length (User mode only)

Specifies the data length in bytes in User mode.

Remote-control command:
`SOUR:BB:WIM:AOFD:DLM:LENG 100`

Data Source (User mode only)

Specifies the data source in User mode.
The DL-MAP contents are filled from the selected data source.
The data sources **PN9**, **PN11, PN15**, **PN16**, **PN20**, **PN21**, **PN23**, **ALL 0**, **ALL1**, **Pattern** and **Data List** are all available to choose from.

Data lists can be generated internally in the data editor or externally. Data lists are selected in the **File Select** window, which is called by means of the **Data List Management** button.

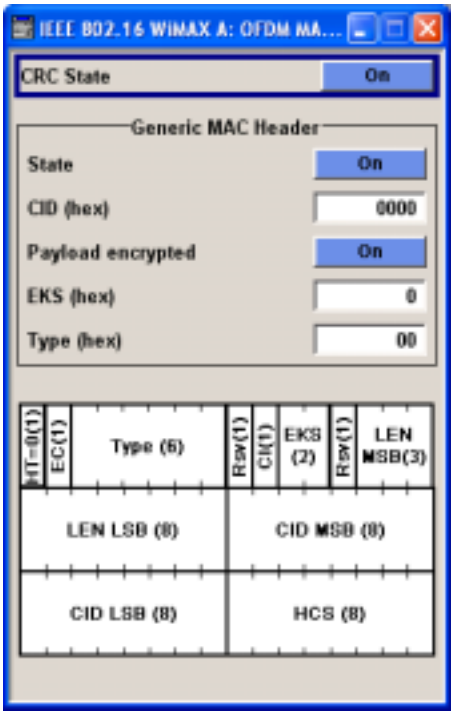
If the **Pattern** data type is used, the bit pattern is defined in the **Pattern** input box. The length is limited to 64 bits.

Remote-control command:
```
SOUR:BB:WIM:AOFD:DLM:DATA PATT
SOUR:BB:WIM:AOFD:DLM:DATA:PATT  #H3F,8

SOUR:BB:WIM:AOFD:DLM:DATA   DLIS
SOUR:BB:WIM:AOFD:DLM:DATA:DSEL "DLMAP"
```

MAC Header Configuration - WiMAX

The **MAC** menu is reached via the **Config...** button of the **MAC Header** column of the burst table
This menu provides settings for a generic MAC header, which is placed at the beginning of the burst when activated.
In addition CRC (cyclic redundancy check) can be activated, which is added at the end of the burst. It covers MAC header and all data.



CRC State

Activates/deactivates the checksum determination. The state of the CRC can be set independently of the state of MAC header generation.

Remote-control command:
`SOUR:BB:WIM:OFDM:BURS2:MAC:CRC:STAT ON`
`SOUR:BB:WIM:AOFD:BURS2:MAC:CRC:STAT ON`

The **Generic MAC Header** section is where the header generation is activated and the header parameters are defined.

State

Activates the generation of the generic MAC header.

Remote-control command: :
`SOUR:BB:WIM:OFDM:BURS2:MAC:STAT ON`
`SOUR:BB:WIM:AOFD:BURS2:MAC:STAT ON`

CID

The command sets the CID (connection control identifier) of the medium access control layer (MAC). The CID identifies a connection to equivalent peers in the MAC of the base station and subscriber station.

Remote-control command:
`SOUR:BB:WIM:OFDM:BURS2:MAC:CID #H333`
`SOUR:BB:WIM:AOFD:BURS2:MAC:CID #H333`

Payload encrypted

Activates/disactivates payload encryption.
If activated, the EC (encryption control) field is set to 1 and the EKS (encryption key sequence) field can be set.

Remote-control command:
```
SOUR:BB:WIM:OFDM:BURS2:MAC:ENCR:STAT ON
SOUR:BB:WIM:AOFD:BURS2:MAC:ENCR:STAT ON
```

EKS

Sets the EKS (encryption key sequence) value in the MAC header. The payload encryption itself is not performed by the signal generator.

Remote-control command:
```
SOUR:BB:WIM:OFDM:BURS2:MAC:EKS 4
SOUR:BB:WIM:AOFD:BURS2:MAC:EKS 4
```

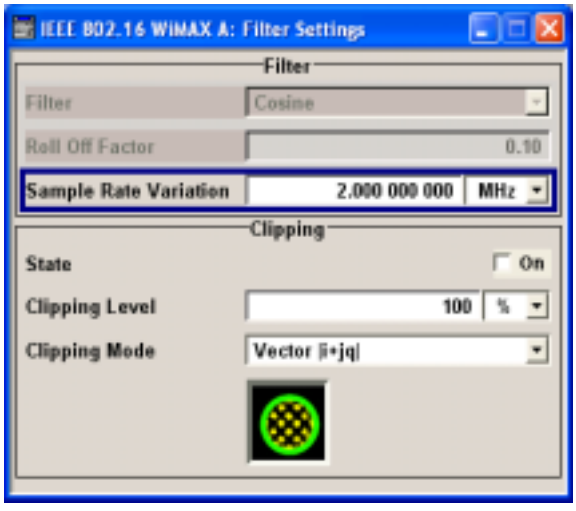
Type

Specifies the MAC type.
The value of the 6-bit type field is set which indicates the payload type, including the presence of subheaders.

Remote-control command:
```
SOUR:BB:WIM:OFDM:BURS2:MAC:TYPE #H333
SOUR:BB:WIM:AOFD:BURS2:MAC:TYPE #H333
```

Filter / Clipping Settings - WiMAX

The **Filter / Clipping** menu is reached via the WiMAX main menu.
The baseband filter, sample rate variation and clipping are defined in this menu.



Filter

Indicates the baseband filter(.
The used filter is a modified cosine filter with a lowered cut off frequency to meet the IEEE spectrum mask requirement.

Remote-control command:
`SOUR:BB:WIM:FILT:TYPE?`

Roll Off Factor

Indicates the filter parameter.
For the default cosine filter a roll off factor of 0.1 is used.

Remote-control command:
`SOUR:BB:WIM:FILT:PAR:COS?`

Sample Rate Variation

Sets the sample rate of the signal.
A variation of this parameter only affects the ARB clock rate, all other signal parameters remain unchanged. If the sampling rate in the frame configuration menu is changed, this parameter is reset to the chosen sampling rate.

Remote-control command:
`SOUR:BB:WIM:SRAT:VAR 40000000`

The settings for clipping are collected in the **Clipping** section.

State

Switches baseband clipping on and off.

Baseband clipping is a very simple and effective way of reducing the crest factor of the WiMAX signal.
With baseband clipping, the signal level is limited to a settable value (Clipping Level). This level is specified as a percentage of the highest peak value. Since clipping is done prior to filtering, the procedure does not influence the spectrum. The EVM however increases.

Remote-control command: `SOUR:BB:WIM:CLIP:STAT ON`

Clipping Level

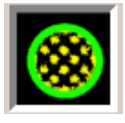
Sets the limit for clipping.
This value indicates at what point the signal is clipped. It is specified as a percentage, relative to the highest level. 100% indicates that clipping does not take place.

Remote-control command:
`SOUR:BB:WIM:CLIP:LEV 50`

Clipping Mode

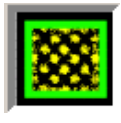
Selects the clipping method. A graphic illustration of the way in which these two methods work is given in the menu.

Vector | i + q | The limit is related to the amplitude | i + q | . The I and Q components are mapped together, the angle is retained.



Remote-control command:
`SOUR:BB:WIM:CLIP:MODE VECT`

Scalar | i | + | q | The limit is related to the absolute maximum of all the I and Q values | i | + | q | .

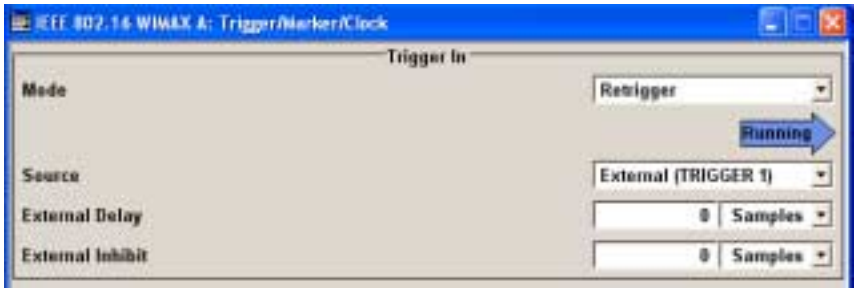


The I and Q components are mapped separately, the angle changes.

Remote-control command:
`SOUR:BB:WIM:CLIP:MODE SCAL`

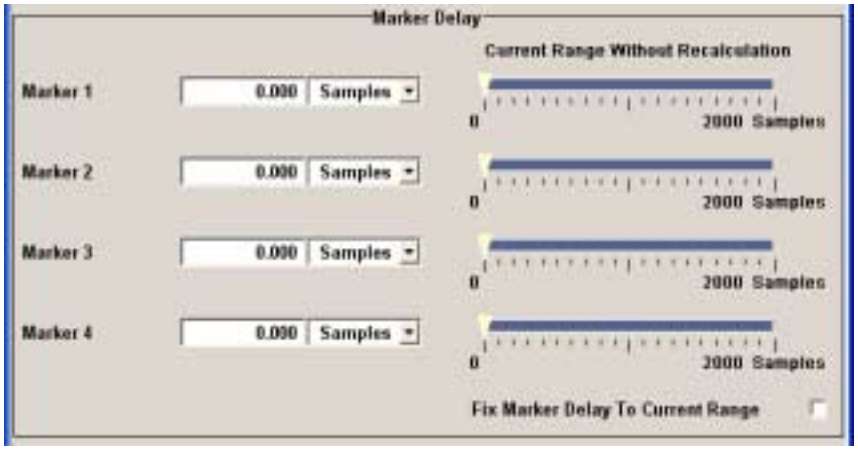
Trigger/Marker/Clock - WiMAX

The **Trigger/Marker/Clock** menu can be reached via the IEEE 802.16 WiMAX main menu.

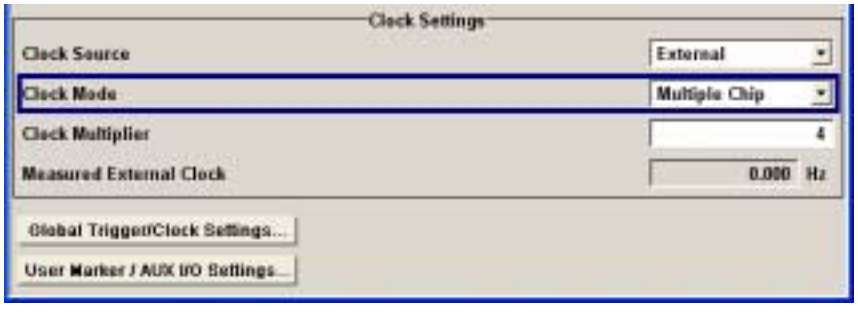


The **Trigger In** section is where the trigger for the IEEE 802.16 WiMAX signal is set. Various parameters will be provided for the settings, depending on which trigger source - internal or external - is selected. The current status of signal generation (**Running** or **Stopped**) is indicated for all trigger modes.

The **Marker Mode** section is where the marker signals at the MARKER output connectors are configured.



The **Marker Delay** section is where a marker signal delay can be defined, either without restriction or restricted to the dynamic section, i.e., the section in which it is possible to make settings without restarting signal and marker generation.



The **Clock Settings** section is where the clock source is selected and - in the case of an external source - the clock type.
The **Global Trigger/Clock Settings** button leads to a submenu for general trigger and clock settings.
The **User marker / AUX I/O Settings** button leads to a submenu for mapping the AUX I/O connector on the rear of the instrument

The **Trigger In** section is where the trigger for the IEEE 802.16 WiMAX signal is set. The current status of the signal generation is displayed for all trigger modes.

Trigger Mode Selects trigger mode.
The trigger mode determines the effect of a trigger on the signal generation.

Auto The IEEE 802.16 WiMAX signal is generated continuously..

Remote-control command::
`SOUR:BB:WIM:SEQ AUTO`

Retrigger The IEEE 802.16 WiMAX signal is generated continuously. A trigger event (internal or external) causes a restart.

Remote-control command:
`SOUR:BB:WIM:SEQ RETR`

Armed_Auto The IEEE 802.16 WiMAX-Signal signal is generated only when a trigger event occurs. Then the signal is generated continuously.

Button **Arm** stops signal generation. A subsequent trigger event (internal with **Execute Trigger** or external) causes a restart.

Remote-control command:
`SOUR:BB:WIM:SEQ AAUT`

Armed_Retrig The IEEE 802.16 WiMAX-Signal signal is generated only when a trigger event occurs. Then the signal is generated continuously. Every subsequent trigger event causes a restart.

Button **Arm** stops signal generation. A subsequent trigger event (internal with **Execute Trigger** or external) causes a restart.

Remote-control command:
`SOUR:BB:WIM:SEQ ARET`

Single The IEEE 802.16 WiMAX signal is generated only when a trigger event occurs. Then the signal is generated once to the length specified at **Signal Duration**. Every subsequent trigger event (internal with **Execute Trigger** or external) causes a restart.

Remote-control command:
`SOUR:BB:WIM:SEQ SING`

Signal Duration

Defines the length of the signal sequence to be output in the **Single** trigger mode. The input is to be expressed in samples. It is then possible to output deliberately just part of the signal, an exact sequence of the signal, or a defined number of repetitions of the signal.

Remote-control commands:
`SOUR:BB:WIM:TRIG:SLEN 2000`

Signal Duration Unit

Defines the unit for the entry of the length of the signal sequence to be output in the **Single** trigger mode. Available units are frame, chip or sequence length (SL).

Remote-control commands:
`SOUR:BB:WIM:TRIG:SLUN FRAM`

Running / Stopped

Displays the status of signal generation for all trigger modes. This display appears only when IEEE 802.16 WiMAX is enabled (**State On**).

Remote-control command:
`SOUR:BB:WIM:TRIG:RMOD?`
Response: RUN or STOP

Running The IEEE 802.16 WiMAX modulation signal is generated; a trigger was (internally or externally) initiated in triggered mode.

If Armed_Auto and Armed_Retrigger have been selected, generation of signals can be stopped with the Arm button. A new trigger (internally with Execute Trigger or externally) causes a restart.

Stopped The signal is not generated, and the instrument waits for a trigger event (internal or external).

Arm

Stops signal generation. This button appears only with **Running** signal generation in the **Armed_Auto** and **Armed_Retrigger** trigger modes.

Signal generation can be restarted by a new trigger (internally with **Execute Trigger** or externally).

Remote-control command:
`SOUR:BB:WIM:TRIG:ARM:EXEC`

Execute Trigger (Trigger Source Internal only)

Executes trigger manually. A manual trigger can be executed only when an internal trigger source and a trigger mode other than Auto have been selected.

Remote-control commands:
`SOUR:BB:WIM:TRIG:SOUR INT`
`SOUR:BB:WIM:SEQ RETR`
`SOUR:BB:WIM:TRIG:EXEC`

Trigger Source

Selects trigger source. This setting is effective only when a trigger mode other than Auto has been selected.

Internal

The trigger event is executed by **Execute Trigger**.

Remote-control command:
`:SOUR:BB:WIM:TRIG:SOUR INT`

Internal (Baseband A/B)

The trigger event is executed by the trigger signal from the second path (two-path instruments only).

Remote-control command:
`SOUR:BB:WIM:TRIG:SOUR OBAS`

External (TRIGGER 1 / 2)

The trigger event is executed with the aid of the active edge of an external trigger signal. The trigger signal is supplied via the TRIGGER 1 or TRIGGER 2 connector.

The polarity, the trigger threshold and the input impedance of the TRIGGER input can be set in the **Global Trigger/Clock Settings** menu.

Remote-control command:
`SOUR:BB:WIM:TRIG:SOUR EXT | BEXT`

External / Trigger Delay (only Trigger Source External / Internal Other baseband)

Sets trigger signal delay in samples on external triggering or on internal triggering via the second path. This enables the R&S Vector Signal Generator to be synchronized with the device under test or other external devices.

Note *The delay can be set separately for each of the two paths.*

Remote-control command::
`SOUR:BB:WIM:TRIG:EXT:DEL 3`
`SOUR:BB:WIM:TRIG:OBAS:DEL 3`

External / Trigger Inhibit (only Trigger Source External / Internal Other baseband)

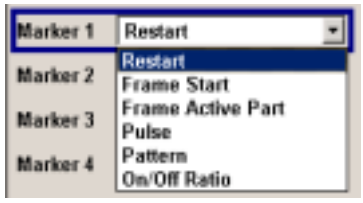
Sets the duration for inhibiting a new trigger event subsequent to triggering. The input is to be expressed in samples.
In the **Retrigger** mode every trigger signal causes signal generation to restart. This restart is inhibited for the specified number of samples.
This parameter is only available on external triggering or on internal triggering via the second path.

Note: *The trigger inhibit can be set separately for each of the two paths.*

Remote-control command:
`SOUR:BB:WIM:TRIG:EXT:INH 1000`
`SOUR:BB:WIM:TRIG:OBAS:INH 1000`

The marker output signal for synchronizing external instruments is configured in the **Marker Settings** section **Marker Mode**.

Marker x Mode - Selects a marker signal for the associated MARKER output.



Restart A marker signal is generated at the start of each ARB sequence.

Remote-control command:
`SOUR:BB:WIM:TRIG:OUTP1:MODE REST`

Frame Start A marker signal is generated at the start of each frame.

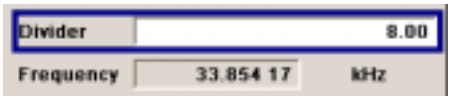
Remote-control command:
`SOUR:BB:WIM:TRIG:OUTP1:MODE FRAM`

Frame Active Part The marker signal is high whenever a burst is active and low during inactive signal parts (such as the gaps between bursts in uplink mode or the uplink subframe in downlink TDD mode).

This marker can be used to decrease the carrier leakage during inactive signal parts by feeding it into the pulse modulator.

Remote-control command:
`SOUR:BB:WIM:TRIG:OUTP1:MODE FACT`

Pulse A regular marker signal is generated. The clock frequency is defined by entering a divider. The frequency is derived by dividing the sample rate by the divider. The input box for the divider opens when **Pulse** is selected, and the resulting pulse frequency is displayed below it.

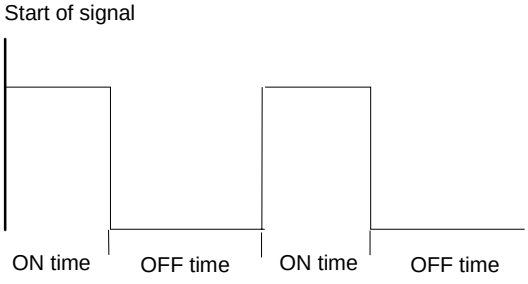


Remote-control commands:
`SOUR:BB:WIM:TRIG:OUTP1:MODE PULS`
`SOUR:BB:WIM:TRIG:OUTP1:PULS:DIV 4`
`SOUR:BB:WIM:TRIG:OUTP1:PULS:FREQ?`

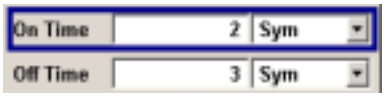
Pattern A marker signal that is defined by a bit pattern is generated. The pattern has a maximum length of 32 bits and is defined in an input field which opens when **pattern** is selected.

Remote-control commands:
`SOUR:BB:WIM:TRIG:OUTP1:MODE PATT`
`SOUR:BB:WIM:TRIG:OUTP1:PATT #B1111,4`

ON/OFF ratio A regular marker signal that is defined by an ON/OFF ratio is generated. A period lasts one ON and OFF cycle.



The ON time and OFF time are each expressed as a number of symbols and are set in an input field which opens when **ON/OFF ratio** is selected.



Remote-control commands:
```
SOUR:BB:WIM:TRIG:OUTP1:MODE RAT
SOUR:BB:WIM:TRIG:OUTP1:OFFT 20
SOUR:BB:WIM:TRIG:OUTP1:ONT  20
```

The **Marker Delay** section can be used to set a delay for the markers.

Marker x Enters the delay between the marker signal at the marker outputs and the start of the signal.
The input is expressed as a number of samples.
If the setting "**Fix marker delay to dynamic range**" is enabled, the setting range is restricted to the dynamic range. In this range the delay of the marker signals can be set without restarting the marker and signal.
The allocation of marker signals to the outputs is described in the section ""*Marker Output Signals*".

Remote-control command:
```
SOUR:BB:WIM:TRIG:OUTP2:DEL 20
```

Current Range without Calculation Displays the dynamic range within which the delay of the marker signals can be set without restarting the marker and signal.
The delay can be defined by moving the setting mark.

Remote-control command:
```
SOUR:BB:WIM:TRIG:OUTP2:DEL:MAX?
SOUR:BB:WIM:TRIG:OUTP2:DEL:MIN?
```

Fix marker delay to current range Restricts the marker delay setting range to the dynamic range. In this range the delay can be set without restarting the marker and signal.

Remote-control command:
```
SOUR:BB:WIM:TRIG:OUTP:DEL:FIX ON
```

The clock source is selected in the **Clock Settings** section.

Clock Source

Selects the clock source (also see section "*Clock Signals*").

Intern

The internal clock reference is used to generate the sample clock.

Remote-control command:
`SOUR:BB:WIM:CLOC:SOUR INT`

Extern

The external clock reference is fed in as the sample clock or multiple thereof via the CLOCK connector.

The sample rate must be correctly set to an accuracy of ± 2 % (see data sheet).

The polarity of the clock input can be changed with the aid of **Global Trigger/Clock Settings**.

In the case of two-path instruments this selection applies to path A.

Remote-control command:
`SOUR:BB:WIM:CLOC:SOUR EXT`

Clock Mode (for external clock source only)

Enters the type of externally supplied clock.

Sample

A sample clock is supplied via the CLOCK connector.

Remote-control command:
`SOUR:BB:WIM:CLOC:MODE SAMP`

Multiple Sample

A multiple of the sample clock is supplied via the CLOCK connector; the sample clock is derived internally from this.

The **Multiplier** window provided allows the multiplication factor to be entered.

Remote-control command:
`SOUR:WIM:CLOC:MODE MSAM`

Sample Clock Multiplier

Enters the multiplication factor for clock type **Multiple Sample**.

Remote-control command:
`SOUR:BB:WIM:CLOC:MULT 4`

Measured External Clock (Clock Source External only)

Displays the measured frequency of the external clock signal. This enables the user to permanently monitor the frequency of the externally introduced clock.

This information is displayed only if the external clock source has been selected.

Remote-control command:
`:CLOC:INP:FREQ?`

Global Trigger/Clock Settings

Calls the **Global Trigger/Clock/Input Settings** menu. This menu is used among other things for setting the trigger threshold, the input impedance and the polarity of the clock and trigger inputs
In the case of two-path instruments these settings are valid for both paths.

The parameters in this menu affect all digital modulations and standards, and are described in the section "*Global Trigger/Clock/Input Settings – Setup -Environment* ".

User Marker AUX I/O Settings

Calls the **User Marker AUX I/O Settings** menu. This menu is used to map the connector on the rear of the instruments see section "*User Marker - AUX IO - Setup-Environment-Global...Settings* ".

SOURce:BB:WIMax Subsystem Remote-Control Commands

WIMax - General Remote-Control Commands

This subsystem contains commands for the primary and general settings of the IEEE 802.16 WiMAX standard. These settings concern activation and deactivation of the standard, setting the transmission direction, filter, clock, trigger and clipping settings, defining the frame duration and the sequence length, as well as the preset setting.
The commands for defining the frame configuration for physical layer modes OFDM and OFDMA are described in the next section. The commands are divided up in this way to make the comprehensive `SOURce:BB:WIMax` subsystem clearer.

The numerical suffix at SOURce distinguishes between path A and path B for two-path instruments:
SOURce<1> = path A
SOURce2 = path B

The keyword SOURce is optional with commands for path A and can be omitted. For path B, the command must include the keyword with the suffix 2.

Command	Parameters	Default unit	Comments
[SOURce<[1]|2>:]BB:WIMax:CLIPping:LEVel	1...100	PCT	
[SOURce<[1]|2>:]BB:WIMax:CLIPping:MODE	VECTor | SCALar		
[SOURce<[1]|2>:]BB:WIMax:CLIPping:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WIMax:CLOCk:MODE	SAMPle | MSAMple		
[SOURce<[1]|2>:]BB:WIMax:CLOCk:MULTiplier	1... 64		
[SOURce<[1]|2>:]BB:WIMax:CLOCk:SOURce	EXTernal | INTernal		
[SOURce<[1]|2>:]BB:WIMax:DUPLexing	TDD | FDD		
[SOURce<[1]|2>:]BB:W3GPp:FILTer:PARameter:COSine	0.05 ... 0.99		
[SOURce<[1]|2>:]BB:W3GPp:FILTer:TYPE			Query only
[SOURce<[1]|2>:]BB:WIMax:FRAMe:BURSt:DELay	0.0 ms ... <frame duration>		
[SOURce<[1]|2>:]BB:WIMax:FRAMe:TIME	MS2 | MS2D5 | MS4 | MS5 | MS8 | MS10 | MS12D5 | MS20 | CONTinuous | USER		
[SOURce<[1]|2>:]BB:WIMax:FRAMe:TIME:USER	0 ... 10E6 s		
[SOURce<[1]|2>:]BB:WIMax:LINK	FORWard | REVerse (Alias DOWN | UP)		
[SOURce<[1]|2>:]BB:WIMax:MODE	OFDM | AOFDm		
[SOURce<[1]|2>:]BB:WIMax:PRESet			No query
[SOURce<[1]|2>:]BB:WIMax:SEQuence	AUTO | RETRigger | AAUTo | ARETrigger | SINGle		
[SOURce<[1]|2>:]BB:WIMax:SETTing:CATalog?			Query only
[SOURce<[1]|2>:]BB:WIMax:SETTing:DELete	<file_name>		
[SOURce<[1]|2>:]BB:WIMax:SETTing:LOAD	<file_name>		
[SOURce<[1]|2>:]BB:WIMax:SETTing:STORe	<file_name>		
[SOURce<[1]|2>:]BB:WIMax:SLENgth	1... MAX		

Command	Parameters	Default unit	Comments
[SOURce<[1]|2>:]BB:WIMax:SRATe:VARiation	400 Hz ... 10 MHz	Hz (c/s)	
[SOURce<[1]|2>:]BB:WIMax:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WIMax:SUBFrame:TIME	0 ... MAX	s	
[SOURce<[1]|2>:]BB:WIMax:TRIGger:ARM:EXECute			No query
[SOURce<[1]|2>:]BB:WIMax:TRIGger:EXECute			No query
[SOURce<[1]|2>:]BB:WIMax:TRIGger[:EXTernal<[1]|2>]:DELay	0 ...(2^32 - 1) samples		
[SOURce<[1]|2>:]BB:WIMax:TRIGger[:EXTernal<[1]|2>]:INHibit	0 ...(2^32 - 1) samples		
[SOURce<[1]|2>:]BB:WIMax:TRIGger:OBASeband:DELay	0 ...(2^32 - 1) samples		
[SOURce<[1]|2>:]BB:WIMax:TRIGger:OBASeband:INHibit	0 ...(2^32 - 1) samples		
[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut<[1]...4>:DELay	0 ...(2^32 - 1) samples		
[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut:DELay:FIXed	ON | OFF	Hz	
[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut<[1]...4>:DELay:MAXimum			Query only
[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut<[1]...4>:DELay:MINimum			Query only
[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut<[1]...4>:MODE	RESTart | FRAMe | FACTive | PULSe | PATTern | RATio		
[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut<[1]...4>:OFFTime	2 ... (2^24 - 1) samples		
[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut<[1]...4>:ONTime	2 ... (2^24 - 1) samples		
[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut<[1]...4>:PATTern	#B0,1...#B111..1,32		
[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut<[1]...4>:PULSe:DIVider	2 ... 1024		
[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut<[1]...4>:PULSe:FREQuency			Query only
[SOURce<[1]|2>:]BB:WIMax:TRIGger:RMODe			Query only
[SOURce<[1]|2>:]BB:WIMax:TRIGger:SLENgth	0 ...(2^32 - 1) samples		
[SOURce<[1]|2>:]BB:WIMax::TRIGger:SLUNit	FRAMe | CHIP | SEQuence		
[SOURce<[1]|2>:]BB:WIMax:TRIGger:SOURce	EXTernal | INTernal | BEXTernal | OBASeband		

[SOURce<[1]|2>:]BB:WIMax:CLIPping:LEVel 0 ... 100 PCT

The command sets the limit for level clipping. This value indicates at what point the signal is clipped. It is specified as a percentage, relative to the highest level. 100% indicates that clipping does not take place.

Level clipping is activated with the command `SOUR:BB:WIM:CLIP:STAT ON`

Example: `"BB:WIM:CLIP:LEV 80PCT"` 'sets the limit for level clipping to 80% of the maximum level.

`"BB:WIM:CLIP:STAT ON"` 'activates level clipping.

*RST value	Resolution	Options	SCPI
100 PCT	1	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:CLIPping:MODE VECTor | SCALar

The command sets the method for level clipping (Clipping).

Parameters:
VECTor The reference level is the amplitude | i+jq |
SCALar The reference level is the absolute maximum of the I and Q values.

Example:
`"BB:WIM:CLIP:MODE SCAL"` 'selects the absolute maximum of all the I and Q values as the reference level.
`"BB:WIM:CLIP:LEV 80PCT"` 'sets the limit for level clipping to 80% of this maximum level.
`"BB:WIM:CLIP:STAT ON"` 'activates level clipping.

*RST value	Resolution	Options	SCPI
VECTor	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:CLIPping:STATe ON | OFF

The command activates level clipping (Clipping). The value is defined with the command `[SOURce:]BB:WIMax:CLIPping:LEVel`, the mode of calculation with the command `[SOURce:]BB:WIMax:CLIPping:MODE` .

Example:
`"BB:WIM:CLIP:STAT ON"` 'activates level clipping.

*RST value	Resolution	Options	SCPI
OFF		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:CLOCk:MODE SAMPle | MSAMple

The command enters the type of externally supplied clock (`:BB:WIMax:CLOCk:SOURce EXTernal`).

When `MSAMple` is used, a multiple of the sample clock is supplied via the CLOCK connector and the sample clock is derived internally from this. The multiplier is entered with the command `:BB:WIMax:CLOCk:MULTiplier`.

With this command the only numerical suffix allowed for SOURce is 1, since the external clock source is permanently allocated to path A.

Example:
`"BB:WIM:CLOC:MODE SAMP"` 'selects clock type **SAMPle**, i.e. the supplied clock is a sample clock.

*RST value	Resolution	Options	SCPI
SAMPle	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:CLOCk:MULTiplier 1 ... 64

The command specifies the multiplier for clock type **Multiplied** (`:BB:WIMax:CLOCk:MODE MSAMple`) in the case of an external clock source.

With this command the only numerical suffix allowed for SOURce is 1, since the external clock source is permanently allocated to path A.

Example:

```
"BB:WIM:CLOC:SOUR EXT"
```
'selects the external clock source. The clock is supplied via the CLOCK connector.

```
"BB:WIM:CLOC:MODE MSAM"
```
'selects clock type **Multiplied**, i.e. the supplied clock has a rate which is a multiple of the sample rate.

```
"BB:WIM:CLOC:MULT 12"
```
'the multiplier for the external clock rate is 12.

*RST value	Resolution	Options	SCPI
4	1	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:CLOCk:SOURce INTernal | EXTernal

The command selects the clock source.

Selecting EXTernal is only possible for path A, since the external clock source is permanently allocated to path A.

Parameter:

INTernal The internal clock reference is used.

EXTernal The external clock reference is supplied to the CLOCK connector.

Example:

```
"BB:WIM:CLOC:SOUR EXT"
```
'selects an external clock reference for path A. The clock is supplied via the CLOCK connector.

```
"BB:WIM:CLOC:MODE SAMP"
```
'specifies that a sample clock is supplied via the CLOCK connector.

*RST value	Resolution	Options	SCPI
INTernal	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:DUPLexing TDD | FDD

The command selects the duplexing. The duplexing mode determines how the uplink and downlink signal are separated.

Parameter:

TDD The same frequency is used for both directions of transmission (uplink and downlink). With one baseband, either downlink or uplink frames can be generated.

FDD

(OFDM only) If only one link direction is considered at once, the IEEE 802.16 standard defines no differences between TDD and FDD signals on the physical layer. The FDD mode has been provided for convenience, it completely fills the defined frame with bursts to simulate a continuous transmission environment. It is recommended to use TDD mode instead if FDD decives are to be tested with frames including transmission gaps.

Example: `"BB:WIM:DUPL FDD"` 'selects frequency division duplexing

*RST value	Resolution	Options	SCPI
TDD	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:FILTer:PARameter:COSine

The command sets the roll-off factor for the Cosine filter type.

The command is a query and therefore does not have an *RST value.

Example: `"BB:WIM:FILT:PAR:COS?"` 'queries the roll-off factor for filter type Cosine.

Response `"0.1"` 'the roll-off factor is set to 0.1.

*RST value	Resolution	Options	SCPI
		B10/B11 and B13 K42 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:FILTer:TYPE

The command queries the baseband filter type.

The command is a query and therefore does not have an *RST value.

Example: `"BB:WIM:FILT:TYPE?"` 'queries the baseband filter type.

Response: `"COS"` 'a cosine filter is used.

*RST value	Resolution	Options	SCPI
		B10/B11 and B13 K42 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:FRAMe:BURSt:DELay 0.0 ms ... 4 294 967 295 000.0 s

The command sets the delay for the first uplink burst.

The command is only available for physical layer mode OFDM in uplink and for FDD duplexing.

Example:
```
"BB:WIM:MODE OFDM"          'selects physical layer mode OFDM
"BB:WIM:LINK UP"            'selects transmission direction uplink
"BB:WIM:DUP FDD"            'selects FDD duplexing
"BB:WIM:FRAM:BURS:DEL 0.004" 'selects a delay of 4 ms for the first burst
```

*RST value	Resolution	Options	SCPI
0	0.0 ms	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:FRAMe:TIME MS2 | MS2D5 | MS4 | MS5 | MS8 | MS10 | MS12D5 | MS20 | CONTinuous | USER

The command selects the frame duration. Only distinct values are allowed in the standard. For test reasons, continuous generation or generation for a freely selectable duration (USER) are available. The user duration is set with command SOUR:BB:WIM:FRAM:TIME:USER. In continuous mode, the frame duration equals the sum of the burst durations.

Example:
```
"BB:WIM:FRAM:TIME MS12D5"   'selects a frame length of 12.5 ms
```

*RST value	Resolution	Options	SCPI
MS10	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:FRAMe:TIME:USER 0.000 ... 10E6 seconds

The command sets the frame duration to a freely selectable value.

Example:
```
"BB:WIM:FRAM:TIME  USER"  'selects a user mode for frame length definition
"BB:WIM:FRAM:TIME:USER 1" 'sets a frame length of 1 s
```

*RST value	Resolution	Options	SCPI
0 ms	0 ms	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:LINK FORWard|DOWN | REVerse|UP

The command defines the transmission direction. The signal either corresponds to that of a base station (FORWard | DOWN) or that of a subscriber station (REVerse | UP).

Example: `"BB:WIM:LINK DOWN"` 'the transmission direction selected is base station to subscriber station. The signal corresponds to that of a base station.

*RST value	Resolution	Options	SCPI
FORWard|DOWN	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:MODE OFDM | AOFDm

The command selects the Physical Layer Mode.

Parameter:

OFDM The OFDM mode supports signal generation according to IEEE 802.16-2004 section 8.3 with a fixed FFT size of 256.

AOFDm Orthogonal Frequency Division Multiple Access (OFDMA) groups multiple subcarriers of the OFDM into sub-channels. A single client or subscriber station might transmit using all of the sub-channels within the carrier space, or multiple clients might transmit with each using a portion of the total number of sub-channels simultaneously. OFDMA thus enables a more flexible use of resources. It can support nomadic and mobile operation.

Example: `"BB:WIM:MODE OFDM"` 'selects physical layer mode OFDM

*RST value	Resolution	Options	Dependencies	SCPI
OFDM	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Duplexing FDD is only possible for physical layer moder OFDM. Duplexing TDD is automatically set when switching to physical layer mode OFDMA.	Device-specific

[SOURce<[1]|2>:]BB:WIMax:PRESet

The command produces a standardized default for the IEEE 802.16 standard. The settings correspond to the *RST values specified for the commands. .

This command triggers an action and therefore has no *RST value and no query form.

Example: `"BB:WIM:PRES"` 'resets all the IEEE 802.16 settings to default values.

*RST value	Resolution	Options	Dependencies	SCPI
-	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	All IEEE 802.16 settings are preset.	Device-specific

[SOURce<[1]|2>:]BB:WIMax:SEQuence AUTO | RETRigger | AAUTo | ARETrigger | SINGle

The command selects the trigger mode.

Parameter:

AUTO The modulation signal is generated continuously.

RETRigger The modulation signal is generated continuously. A trigger event (internal or external) causes a restart.

AAUTo The modulation signal is generated only when a trigger event occurs. After the trigger event the signal is generated continuously. Signal generation is stopped with command `SOUR:BB:WIM:TRIG:ARM:EXEC` and started again when a trigger event occurs.

ARETrigger The modulation signal is generated only when a trigger event occurs. The device automatically toggles to RETRIG mode. Every subsequent trigger event causes a restart.
Signal generation is stopped with command `SOUR:BB:WIM:TRIG:ARM:EXEC` and started again when a trigger event occurs.

SINGle
The modulation signal is generated only when a trigger event occurs. Then the signal is generated once to the length specified with command `SOUR:BB:WIM:TRIG:SLEN`. Every subsequent trigger event causes a restart.

Example: `"BB:WIM:SEQ AAUT"` 'sets the **Armed_auto** trigger mode; the device waits for the first trigger (e.g. with `*TRG`) and then generates the signal continuously.

*RST value	Resolution	Options	SCPI
AUTO	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:SETTing:CATalog?

This command reads out the files with IEEE 802.16 settings in the default directory. The default directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. Only files with the file extension ***.wimax** will be listed.

The command is a query command and therefore has no *RST value.

Example: `"MMEM:CDIR 'D:\user\wimax"` 'sets the default directory to D:\user\wimax.

`"BB:WIM:SETT:CAT?"` 'reads out all the files with IEEE 802.16 settings in the default directory.

Response: `"'ofdm','fbpsk'"` the files `''ofdm'` and `'fbpsk''` are available.

*RST value	Resolution	Options	SCPI
	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:SETTing:DELete <file_name>

This command deletes the selected file with IEEE 802.16 WiMAX settings The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. The file extension may be omitted. Only files with the file extension ***.wimax** will be deleted.

This command triggers an event and therefore has no *RST value and no query form.

Example: `"BB:WIM:SETT:DEL 'ofdm'"` 'deletes file '`ofdm`'.

*RST value	Resolution	Options	SCPI
	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:SETTing:LOAD <file_name>

This command loads the selected file with IEEE 802.16 WiMAX settings The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. The file extension may be omitted. Only files with the file extension ***.wimax** will be loaded.

This command triggers an event and therefore has no *RST value and no query form.

Example: `"BB:WIM:SETT:LOAD 'ofdm'"` 'loads file '`ofdm`'.

*RST value	Resolution	Options	SCPI
	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:SETTing:STORe <file_name>

This command stores the current IEE 802.16 WIMAX settings into the selected file The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. Only the file name has to be entered. IEE 802.16 WIMAX settings are stored as files with the specific file extensions ***.wimax**.

This command triggers an event and therefore has no *RST value and no query form.

Example: `"BB:WIM:SETT:STOR 'ofdm_tdd'"`
'stores the current settings into file '`ofdm_tdd`'.

*RST value	Resolution	Options	SCPI
	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:SLENgth 1 ... max

The command selects the number of frames. The maximum number of frames depends on the sampling rate, the set frame length (2 x sampling rate x frame length / command `BB:WIM:FRAM:TIM`) and the supplied ARB memory size (option B10 or B11)

Example: `"BB:WIM:SLEN 4"` 'selects the generation of 4 frames.

*RST value	Resolution	Options	SCPI
1	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:SRATe:VARiation 1 Mcps ... 40 Mcps

The command enters the output sample rate.

A variation of this parameter only affects the ARB clock rate, all other signal parameters remain unchanged. If the sampling rate in the frame configuration menu is changed, this parameter is reset to the chosen sampling rate.

Example: `"BB:WIM:SRAT:VAR 4000000"` "sets the output sample rate to 4 Mcps.

*RST value	Resolution	Options	SCPI
2 MHz	0.001 Hz	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:STATe ON | OFF

The command activates modulation in accordance with the IEE 802.16 WIMAX standard. Activating this standard deactivates all the other digital standards and digital modulation modes on the same path.

Example: `"BB:WIM:STAT ON"` 'activates modulation in accordance with the IEE 802.16 WiMAX standard.

*RST value	Resolution	Options	Dependencies	SCPI
OFF	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	`BB:WIM:STAT ON` deactivates the other standards and digital modulation.	Device-specific

[SOURce<[1]|2>:]BB:WIMax:SUBFrame:TIME 0.0 ... MAX

The command set the duration of the downlink subframe.

The command is only available for uplink direction and when TDD is selected on the same path.

Example:
```
"BB:WIM:LINK UP"          'selects uplink transmission.
"BB:WIM:DUPL TDD"         'selects time division duplexing.
"BB:WIM:SUBF:TIME 2ms"    'sets a subframe duration of 1 ms.
```

*RST value	Resolution	Options	SCPI
0	1 ms	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger:ARM:EXECute

The command stops signal generation for trigger modes Armed_Auto and Armed_Retrigger. A subsequent internal or external trigger event restart signal generation.

This command triggers an event and therefore has no *RST value and no query form.

Example:
```
"BB:WIM:TRIG:SOUR INT"    'sets internal triggering.
"BB:WIM:TRIG:SEQ ARET"    'sets Armed_Retrigger mode, i.e. every
                          trigger event causes signal generation to
                          restart.
"BB:WIM:TRIG:EXEC"        'executes a trigger, signal generation is
                          started.
"BB:WIM:TRIG:ARM:EXEC"    'signal generation is stopped.
"BB:WIM:TRIG:EXEC"        'executes a trigger, signal generation is
                          started again.
```

*RST value	Resolution	Options	SCPI
		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger:EXECute

The command executes a trigger. The internal trigger source must be selected using the command `:BB:WIM:TRIG:SOUR INT` and a trigger mode other than `AUTO` must be selected using the command `:BB:WIM:TRIG:SEQ`.

This command triggers an event and therefore has no *RST value and no query form.

Example:
```
"BB:WIM:TRIG:SOUR INT"      'sets internal triggering.
"BB:WIM:TRIG:SEQ RETR"      'sets Retrigger mode, i.e. every trigger event causes signal generation to restart.
"BB:WIM:TRIG:EXEC"          'executes a trigger.
```

*RST value	Resolution	Options	SCPI
		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger[:EXTernal<[1]|2>]:DELay 0 ... 2^32-1

The command specifies the trigger delay (expressed as a number of samples) for external triggering. The numeric suffix to EXTernal distinguishes between the external trigger via the TRIGGER 1 (suffix 1) and TRIGGER 2 (suffix 2) connector.

Example:
```
"BB:WIM:TRIG:SOUR EXT"      'sets an external trigger via the TRIGGER 1 connector.
"BB:WIM:TRIG:DEL 50"        'sets a delay of 50 samples for the trigger.
```

*RST value	Resolution	Options	SCPI
0 samples	1 sample	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger[:EXTernal<[1]|2>]:INHibit 0 ... 2^32-1

The command specifies the number of samples by which a restart is to be inhibited following a trigger event. This command applies only in the case of external triggering. The numeric suffix to EXTernal distinguishes between the external trigger via the TRIGGER 1 (suffix 1) and TRIGGER 2 (suffix 2) connector.

Example:
```
"BB:WIM:TRIG:SOUR EXT"      'selects an external trigger via the TRIGGER 1 connector
"BB:WIM:TRIG:INH 200"       'sets a restart inhibit for 200 samples following a trigger event.
```

*RST value	Resolution	Options	SCPI
0 samples	1 sample	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger:OBASeband:DELay 0 ... 2^32-1

The command specifies the trigger delay (expressed as a number of samples) for triggering by the trigger signal from the second path (two-path instruments only).

Example:
```
"BB:WIM:TRIG:SOUR OBAS"
```
'sets for path A the internal trigger executed by the trigger signal from the second path (path B).
```
"BB:WIM:TRIG:OBAS:DEL 50"
```
'sets a delay of 50 samples for the trigger.

*RST value	Resolution	Options	SCPI
0 samples	1 samples	B10/B11 and B13 K49Only with second option B13	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger:OBASband:INHibit 0 ... 2^32-1

The command specifies the number of samples by which a restart is to be inhibited following a trigger event. This command applies only for triggering by the second path (two-path instruments only).

Example:
```
"BB:WIM:TRIG:SOUR OBAS"
```
'sets for path A the internal trigger executed by the trigger signal from the second path (path B).
```
"BB:WIM:TRIG:INH 200"
```
'sets a restart inhibit for 200 samples following a trigger event.

*RST value	Resolution	Options	SCPI
0 samples	1 sample	B10/B11 and B13 K49Only with second option B13	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut<[1]...4>:DELay 0 ... 2^32 - 1 Samples

The command defines the delay between the signal on the marker outputs and the start of the signal, expressed in terms of samples. Command `:BB:WIMax:TRIGger:OUTPut:DELay:FIXed` can be used to restrict the range of values to the dynamic range, i.e. the range within which a delay of the marker signals can be set without restarting the marker and signal.

Example:
```
"BB:WIM:TRIG:OUTP2:DEL 1600"
```
'sets a delay of 1600 samples for the signal on connector MARKER 2.

*RST value	Resolution	Options	SCPI
0	1 sample	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut:DELay:FIXed ON | OFF

The command restricts the marker delay setting range to the dynamic range. In this range the delay can be set without restarting the marker and signal. If a delay is entered in setting ON but is outside this range, the maximum possible delay is set and an error message is generated.

Example: `"BB:WIM:TRIG:OUTP:DEL:FIX ON"` 'restricts the marker signal delay setting range to the dynamic range.

*RST value	Resolution	Options	SCPI
OFF	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut<[1]...4>:DELay:MAXimum

The command queries the maximum marker delay for setting `:BB:WIMax:TRIG:OUTP:DEL:FIX ON`.

The command is a query only and therefore has no *RST value.

Example: `"BB:WIM:TRIG:OUTP:DEL:FIX ON"` 'restricts the marker signal delay setting range to the dynamic range.

`"BB:WIM:TRIG:OUTP:DEL:MAX"` 'queries the maximum of the dynamic range.

Response: `"2000"` 'the maximum for the marker delay setting is 2000 samples.

*RST value	Resolution	Options	SCPI
-	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut<[1]...4>:DELay:MINimum

The command queries the minimum marker delay for setting `:BB:WIMax:TRIGger:OUTPut:DELay:FIXed ON`.

The command is a query only and therefore has no *RST value.

Example: `"BB:WIM:TRIG:OUTP:DEL:FIX ON"` 'restricts the marker signal delay setting range to the dynamic range.

`"BB:WIM:TRIG:OUTP:DEL:MIN"` 'queries the minimum of the dynamic range.

Response: `"0"` 'the minimum for the marker delay setting is 0 samples.

*RST value	Resolution	Options	SCPI
-	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut<[1]...4>:MODE
RESTart | FRAMe | FACTive | PULSe | PATTern | RATio

The command defines the signal for the selected marker output.

Parameter:

RESTart A marker signal is generated at the start of each sequence (the sequence length is set with command `SOUR:BB:WIM:FCOunt`).

FRAMe A marker signal is generated at the start of each frame (the frame length is set with command `SOUR:BB:WIM:FRAM:TIME`).

FACTive The marker signal is high whenever a burst is active and low during inactive signal parts (such as the gaps between bursts in uplink mode or the uplink subframe in downlink TDD mode). This marker can be used to decrease the carrier leakage during inactive signal parts by feeding it into the pulse modulator.

PATTern A marker signal is generated according to the user defined pattern (command `SOURce:BB:WIMax:TRIGger:OUTPut:PATTern`).

RATio A marker signal corresponding to the Time Off / Time On specifications in the commands `SOURce:BB:WIMax:TRIGger:OUTPut:OFFT` and `SOURce:BB:WIMax:TRIGger:OUTPut:ONT` is generated.

Example:
```
"BB:WIM:TRIG:OUTP2:MODE FRAMe"
```
'selects the frame marker signal on output MARKER 2.

*RST value	Resolution	Options	SCPI
RESTart	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut<[1]...4>:OFFTime 1.. 2^24 - 1 (1..16 777 215) samples

The command sets the number of samples in a period (ON time + OFF time) during which the marker signal in setting `SOURce:BB:WIMax:TRIGger:OUTPut:MODE RATio` on the marker outputs is OFF.

Example:
```
"BB:WIM:TRIG:OUTP2:OFFT 200"
```
'sets an OFF time of 200 samples for marker signal 2 on path A.

*RST value	Resolution	Options	SCPI
1	1	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut<[1]...4>:ONTime 1.. 2^24 - 1 (1..16 777 215) samples

The command sets the number of samples in a period (ON time + OFF time) during which the marker signal in setting `SOURce:BB:WIM:TRIGger:OUTPut:MODE RATio` on the marker outputs is ON.

Example: `"BB:WIM:TRIG:OUTP2:ONT 200"` 'sets an ON time of 200 samples for marker 2 on path A.

*RST value	Resolution	Options	SCPI
1	1	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut<[1]...4>:PATTern #B0,1 ... #B111...1, 2

The command defines the bit pattern used to generate the marker signal in the setting `SOURce:BB:WIMax:TRIGger:OUTPut:MODE PATTern`. 0 is marker off, 1 is marker on

Example: `"BB:WIM:TRIG:OUTP2:PATT #B000000011111111,15"`
'sets a bit pattern.

`"BB:WIM:TRIG:OUTP2:MODE PATT"` 'activates the marker signal according to a bit pattern on output MARKER 2.

*RST value	Resolution	Options	SCPI
#B,1	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut<[1]...4>:PULSe:DIVider 2 ... 2^10

The command sets the divider for Pulse marker mode (`SOUR:BB:WIM:TRIG:OUTP:MODE PULSe`.). The resulting pulse frequency is derived by dividing the symbol rate by the divider.

Example: `"BB:WIM:TRIG:OUTP2:PULS:DIV 2"` 'sets the divider to 2 for the path A marker signal on output MARKER 2.

`"BB:WIM:TRIG:OUTP2:FREQ?"` 'queries the resulting pulse frequency of the marker signal.

Response: `"66 000"` 'the resulting pulse frequency is 66 kHz.

*RST value	Resolution	Options	SCPI
2	1	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger:OUTPut<[1]...4>:PULSe:FREQuency?

The command queries the pulse frequency of the pulsed marker signal in the setting SOURce:BB:WIMax:TRIGger:OUTPut:MODE PULSe. The pulse frequency is derived by dividing the symbol rate by the divider.

The command is a query command and therefore has no *RST value.

Example:

"BB:WIM:TRIG:OUTP2:PULS:DIV 2"	'sets the divider for the path A marker signal on output MARKER 2 to the value 2.
"BB:WIM:TRIG:OUTP2:MODE PULS"	'enables the pulsed marker signal.
"BB:WIM:TRIG:OUTP2:PULS:FREQ?"	'queries the pulse frequency of the marker signal.
Response: "33 000"	'the resulting pulse frequency is 33 kHz.

*RST value	Resolution	Options	SCPI
-	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger:RMODe

The command queries the current status of signal generation for all trigger modes with IEEE 802.16 WiMAX modulation on.

The command is a query command and therefore has no *RST value.

Parameter:

RUN	the signal is generated. A trigger event occurred in the triggered mode.
STOP	the signal is not generated. A trigger event did not occur in the triggered modes, or signal generation was stopped by the command :BB:WIM:TRIG:ARM:EXECute (armed trigger modes only).

Example:

"SOUR2:BB:WIM:TRIG:SOUR EXT"	'sets external triggering via the TRIGGER 1 connector for path B of a two-path instrument.
"SOUR2:BB:WIM:TRIG:MODE ARET"	'selects the Armed_Retrigger mode
"SOUR2:BB:WIM:TRIG:RMOD?"	'queries the current status of signal generation.
Response: "RUN"	'the signal is generated, an external trigger was executed.

*RST value	Resolution	Options	SCPI
-	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger:SLENgth 1 … (2^32-1) samples

The command defines the length of the signal sequence to be output in the **Single** trigger mode (`SOUR:BB:WIMax:SEQ SING`). The input is made in terms of samples.

It is possible to output deliberately just part of the frame, an exact sequence of the frame, or a defined number of repetitions of the frame. The unit is defined with command `SOUR:BB:WIMax:TRIG:SLUNit`.

Example:
`"SOUR2:BB:WIM:SEQ SING"` 'sets trigger mode Single .

`"SOUR2::BB:WIM:TRIG:SLEN 200"` 'sets a sequence length of 200 samples. The first 200 samples of the current frame will be output after the next trigger event.

*RST value	Resolution	Options	SCPI
32 768 samples	1 sample	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger:SLUNit FRAMe | CHIP | SEQuence

The command defines the unit for the entry of the length of the signal sequence (`SOUR:BB:WIMax:TRIG:SLEN`) to be output in the **Single** trigger mode (`SOUR:BB:WIMax:SEQ SING`).

Parameter:
FRAMe Unit Frame. A single frame is generated after a trigger event.

CHIP Unit Chip. A single chip is generated after a trigger event.

SEQuence Unit Sequence Length. A single sequence is generated after a trigger event.

Example:
`"SOUR:BB:WIM:SEQ SING"` 'sets trigger mode Single.

`"SOUR:BB:WIM:TRIG:SLUN FRAM"` 'sets unit Frame length for the entry of sequence length.

`"SOUR:BB:WIM:TRIG:SLEN 2"` 'sets a sequence length of 2 frame. Two frames will be output after the next trigger event.

*RST value	Resolution	Options	SCPI
SEQuence	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:TRIGger:SOURce INTernal | EXTernal | BEXTernal | OBASeband

The command selects the trigger source.

Parameter:

INTernal Triggering is executed by means of the Trigger command `SOURce<[1]|2>:BB:WIM:TRIGger:EXECute` or `*TRG` in the case of remote control and by means of **Execute Trigger** in the case of manual operation.

EXTernal Triggering is executed by means of the signal on the TRIGGER 1 connector.

BEXTernal Triggering is executed by means of the signal on the TRIGGER 2 connector.

OBASeband Triggering is executed by means of the trigger signal from the second path (two-path instruments only).

Example:

```
"SOUR2:BB:WIM:TRIG:SOUR EXT"
```

'sets external triggering via the TRIGGER 1 connector for path B of a two-path instrument .

*RST value	Resolution	Options	SCPI
INTernal	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

SOURce-WIMax - Physical Layer Settings

The SOURce:BB:WIMax:OFDM andSOURce:BB:WIMax:AOFDm systems contain commands for setting the characteristics of signals with OFDM and OFDMA physical layer.

Important: *In case of remote control, suffix counting for bursts corresponds to the suffix counting with WiMAX starting with burst 0. SCPI prescribes that suffix 1 is the default state and used when no specific suffix is specified. Therefore, burst 1 (and not burst 0) is selected when no suffix is specified*

Command	Parameters	Default unit	Com ments
[SOURce<[1]|2>:]BB:WIMax:OFDM:BSID	0...15		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BSID	0...15		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt[:COUNt]	1...8		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt[:COUNt]	1...8		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:CCODing:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:CCODing:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:CONFlict[:STATe]	ON | OFF		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:DATA	PN9 | PN15 | PN16 | PN20 | PN21 | PN23 | ZERO | ONE | PATTern | DLISt		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:DATA	PN9 | PN15 | PN16 | PN20 | PN21 | PN23 | ZERO | ONE | PATTern | DLISt		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:DATA:DSELect	<dlist_name>		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:DATA:DSELect	<dlist_name>		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:DATA:LENGth	0 .. 10 000	bytes	
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:DATA:PATTern	#B0,1...B11..1,64		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:DATA:PATTern	#B0,1...B11..1,64		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:DIUC	0.0 ... 15.0		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:DIUC	0.0 ... 15.0		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:DLENgth	0 .. 10 000	Bytes	
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:FORMat	QPSK1D2 | QPSK3D4 | 16QAM1D2 | 16QAM3D4 | 64QAM1D2 | 64QAM2D3 | 64QAM3D4		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:FORMat	BPSK1D2 | QPSK1D2 | QPSK3D4 | QAM1D2X16 | QAM3D4X16 | QAM2D3X64 | QAM3D4X64		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:GAP	0 us ... 1 000 000 us	s	
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:MAC:CID	H0 ... HFFFF		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:MAC:CID	H0 ... HFFFF		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:MAC:CRC:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:MAC:CRC:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:MAC:EKS	0 ... 4		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:MAC:EKS	0 ... 4		

Command	Parameters	Default unit	Comments
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:MAC:ENCRypted:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:MAC:ENCRypted:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:MAC:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:MAC:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:MAC:TYPE	0 ... 0x40		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:MAC:TYPE	#H0...#H3F		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:MIDamble	OFF | REP5 | REP9 | REP17		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:OFFSet:MODE	USER | AUTO		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:OFFSet:SUBChannel			
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:OFFSet:SYMBol			
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:POWer	-80 dB ... 0 dB	dB	
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:POWer	-80 dB ... 0 dB	dB	
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:PREamble:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:SLOT:COUNt	0 ...		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:SUBChannel:COUNt			
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:SYMBol[:COUNt]	0 ... MAX		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:SYMBol[:COUNt]	0 ... MAX		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:UIUC	0.0 ... 15.0		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:BW	1.25E6 ... 28E6		
[SOURce<[1]|2>:]BB:WIMax:OFDM:BW	1.25E6 ... 28E6		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:BSID	#H0,0...#H2322222222FF,48		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:DATA	ZERO | ONE | PATTern | PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | DLISt		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:DATA:DCD[:COUNt]	0 .255		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:DATA:DSELect	<dlist_name>		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:DATA:PATTern	#B0,1...B11..1,64		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:FNOFfset	0 ... 16777215		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:LENGth	0 ... 1000		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:MODE	AUTO | USER		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:REPCoding	RC0 | RC2 | RC4 | RC6		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:FBANd	ETSi | MMDS | WCS | USER		
[SOURce<[1]|2>:]BB:WIMax:OFDM:FBANd	ETSI | MMDS | WCS | UNII | USER		
[SOURce<[1]|2>:]BB:WIMax:OFDM:FCH:CCC	0 ... 15		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:FCH:DATA	PN9 | PN15 | PN16 | PN20 | PN21 | PN23 | ZERO | ONE | PATTern | DLISt		
[SOURce<[1]|2>:]BB:WIMax:OFDM:FCH:DATA	PN9 | PN15 | PN16 | PN20 | PN21 | PN23 | ZERO | ONE | PATTern | DLISt		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:FCH:DATA:DSELect	<dlist_name>		
[SOURce<[1]|2>:]BB:WIMax:OFDM:FCH:DATA:DSELect	<dlist_name>		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:FCH:DATA:PATTern	#B0,1...B11..1,64		
[SOURce<[1]|2>:]BB:WIMax:OFDM:FCH:DATA:PATTern	#B0,1...B11..1,64		
[SOURce<[1]|2>:]BB:WIMax:OFDM:FCH:FNOFfset	0 ... 15		

Command	Parameters	Default unit	Comments
[SOURce<[1]|2>:]BB:WIMax:AOFDm:FCH:MODE	AUTO | USER		
[SOURce<[1]|2>:]BB:WIMax:OFDM:FCH:MODE	AUTO | USER		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:FCH:STATe	IN | OFF		
[SOURce<[1]|2>:]BB:WIMax:OFDM:FCH:STATe	IN | OFF		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:FFT	FFT128 | FFT512 | FFT1024 | FFT2048		
[SOURce<[1]|2>:]BB:WIMax:OFDM:FFT			Query only
[SOURce<[1]|2>:]BB:WIMax:OFDM:FRAMe:PREDefined	USER | FBPSK12SHORT | FBPSK12MID | FBPSK12LONG | FQPSK12SHORT | FQPSK12MID | FQPSK12LONG | FQPSK34SHORT | FQPSK34MID | FQPSK34LONG | F16QAM12SHORT | F16QAM12MID | F16QAM12LONG | F16QAM34SHORT | F16QAM34MID | F16QAM34LONG | F64QAM23SHORT | F64QAM23MID | F64QAM23LONG | F64QAM34SHORT | F64QAM34MID | F64QAM34LONG		
[SOURce<[1]|2>:]BB:WIMax:OFDM:FRAMe[:NUMBer]	0 ... 15		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:IDCell	0.0 ...69.0		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:N			Query only
[SOURce<[1]|2>:]BB:WIMax:OFDM:N			Query only
[SOURce<[1]|2>:]BB:WIMax:AOFDm:POWer:REFerence	RMS | PREamble		
[SOURce<[1]|2>:]BB:WIMax:OFDM:POWer:REFerence	BURSt | PREamble		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:PREamble:INDex	0 ... 113		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:PREamble:INDex:MODE	AUTO | USER		
[SOURce<[1]|2>:]BB:WIMax:OFDM:PREamble:MODE	OFF | LONG | SHORT		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:SCARrier:PERMutation	FUSC | PUSC		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:SRATe	1.44E6 ... 32E6		
[SOURce<[1]|2>:]BB:WIMax:OFDM:SRATe	Slot 0 ...slot 14		
[SOURce<[1]|2>:]BB:WIMax:OFDM:SUBChannel[:COUNt]	SC1 | SC2 | SC4 | SC8 | SC16		
[SOURce<[1]|2>:]BB:WIMax:OFDM:SUBHannel:INDex	0 ... 15		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:SUBChannel<CH>:MAP	ON | OFF		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:SUBChannel:MODE	ALL | USER		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:SUBChannel:PATTern	#B0,1...B11..1,72		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:TGTB	1D4 | 1D8 | 1D16 | 1D32		
[SOURce<[1]|2>:]BB:WIMax:OFDM:TGTB	TGTB1D4 | TGTB1D8 | TGTB1D16 | TGTB1D32		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:ULIDcell	0.0 ... 69.0		
[SOURce<[1]|2>:]BB:WIMax:AOFDm:ULZone:SYMBol[:COUNt]		symbols	

[SOURce<[1]|2>:]BB:WIMax:OFDM:BSID 1 ... 15

The command sets the 4 LSBs of the Base Station ID.. Only the four least significant bits are given. The BSID is transmitted in the FCH (when set to **Auto** mode), and it is used to initialize the randomizer.).

Example: `"BB:WIM:OFDM:BSID 2"` 'the base station id is 2.

*RST value	Resolution	Options	SCPI
0	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt[:COUNt] 1 ... 8

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt[:COUNt] 1 ... 8

The command sets the number of active bursts in one frame. With number of bursts = 0, a preamble only or a preamble with an FCH burst is generated.).

Example: `"BB:WIM:OFDM:BURS:COUN 2"` 'two bursts are sent in one frame.

*RST value	Resolution	Options	SCPI
1	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt:CCODing:STATe ON | OFF

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt:CCODing:STATe ON | OFF

The command switches channel coding on or off. . If channel coding is switched off, the bits read from the data source are directly modulated onto the carriers. Due to randomization missing, this could result in very high crest factors of the signal..

Example: `"BB:WIM:OFDM:BURS:CCOD:STAT ON"` 'activates channel coding for burst 1.

*RST value	Resolution	Options	SCPI
ON	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt:CONFlict[:STATe]

The command indicates a conflict between two bursts. Conflicts can occur if subchannel and symbol offsets are set manually and two or more bursts overlap. Bursts can also overlap with the FCH or DL-MAP. The position of FCH and DL-MAP is fixed and cannot be changed.

The command is a query and therefore does not have an *RST value.

Example: `"BB:WIM:AOFD:BURS:CONF?"` 'queries if there exist a conflict between the activated OFDMA bursts.

Response: `"0"` 'there exists not conflict between the activated OFDMA bursts.

*RST value	Resolution	Options	SCPI
-	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:DATA
PN9 | PN15 | PN16 | PN20 | PN21 | PN23 | DLISt | ZERO | ONE | PATTern | USB

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:DATA
PN9 | PN15 | PN16 | PN20 | PN21 | PN23 | DLISt | ZERO | ONE | PATTern

The command determines the data source for the specified bursts.

Parameters:

PNxx The pseudo-random sequence generator is used as the data source. Different random sequence lengths can be selected.

DLISt A data list is used. The data list is selected with the command `:BB:WIMax:OFDM:BURS:DATA:DSELect`.

ZERO | ONE Internal 0 and 1 data is used

PATTern Internal data is used The bit pattern for the data is defined by the command `:BB:WIMax:OFDM:BURS:DATA:PATTern`.

USB The data is supplied externally via the USB interface.

Example: `"BB:WIM:OFDM:BURS:DATA PATT"` 'selects as the data source for the data fields of burst 1, the bit pattern defined with the following command.

`"BB:WIM:OFDM:BURS:DATA:PATT #H3F,8"` 'defines the bit pattern.

*RST value	Resolution	Options	SCPI
PN9	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:DATA:DSELect <data list name>

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:DATA:DSELect <data list name>

The command selects the data list for the DLISt data source selection.

The lists are stored as files with the fixed file extensions ***.dm_iqd** in a directory of the user's choice. The directory applicable to the following commands is defined with the command `MMEMory:CDIR`. To access the files in this directory, you only have to give the file name, without the path and the file extension.

Example:

```
"BB:WIM:OFDM:BURS:DATA DLIS"
```
'selects the Data Lists data source.

```
"MMEM:CDIR 'D:\Lists\DM\IqData'"
```
'selects the directory for the data lists.

```
"BB:WIM:OFDM:BURS:DATA:DLIS 'wimax_list1'"
```
'selects file '`wimax_list1`' as the data source. This file must be in the directory `D:\Lists\DM\IqData` and have the file extension *.dm_iqd.

*RST value	Resolution	Options	SCPI
-	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:DATA:PATTern
#B0,1... #B111..1,64

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:DATA:PATTern
#B0,1... #B111..1,64

The command determines the bit pattern for the PATTern selection. The maximum length is 64 bits.

Example:

```
"BB:WIM:OFDM:BURS:DATA:PATT  #H3F,8"
```
'defines the bit pattern.

*RST value	Resolution	Options	SCPI
0	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:DIUC 0 ... 15

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:DIUC 0 ... 15

The command sets the specific interval usage code for downlink. The code is used to initialize the randomizer. and is transmitted in the FCH

Example: "BB:WIM:OFDM:BURS2:DIUC 12" 'sets Downlink Interval Usage Code12 for burst 2.

*RST value	Resolution	Options	SCPI
1		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:DLENgth 0 ... 10 000 Bytes

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:DLENgth 0 ... 10 000 Bytes

The command sets the data length in bytes. The given number of bytes is read from the data source. The total number of data bytes in the burst (before channel coding) is determined as follows:

TotalDataBytes = DataLength + MACHeaderBytes + CRCBytes + TailByte

The tail byte is only added when channel coding is switched on. The same is the case for the MAC header and CRC, they are not added when switched off. Additionally padding with 0xFF bytes is applied at the end of the data sequence to reach an integer number of OFDM symbols.

The data length determines the number of symbols and vice versa. The maximum data length of 10000 bytes defines the maximum number of symbols for a given modulation type and channel coding rate.

Example: "BB:WIM:OFDM:BURS:DLEN 256'" 'sets a data length of 256.

*RST value	Resolution	Options	SCPI
100	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:FORMat QPSK1D2 | QPSK3D4 | 16QAM1D2 | 16QAM3D4 | 64QAM1D2 | 64QAM2D3 | 64QAM3D4

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:FORMat BPSK1D2 | QPSK1D2 | QPSK3D4 | QAM1D2X16 | QAM3D4X16 | QAM2D3X64 | QAM3D4X64

Selects the modulation and channel coding rate. Channel coding includes randomization, reed solomoon coding, convoutional coding and interleaving.

For a given modulation type and channel coding rate, the data length determines the number of symbols and vice versa.

Example: `"BB:WIM:OFDM:BURS:FORM QAM3D4X64"`
'selects modulation type 64QAM and a channel coding rate of 3.4 Msamples for burst 1.

*RST value	Resolution	Options	SCPI
BPSK1D2	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:GAP 0 ... 1 s

The command sets the length of the gap between the selected burst and the next burst in µs. The setting is only available for transmission direction uplink.

Example: `"BB:WIM:LINK UP"` 'sets transmission direction uplink.

`"BB:WIM:OFDM:BURS2:GAP 0.003"`
'sets the gap between burst 2 and 3 to 3 ms.

*RST value	Resolution	Options	SCPI
0	1 us	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:MAC:CID #H0...#HFFFF

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:MAC:CID #H0...#HFFFF

The command sets the CID (connection control identifier) of the medium access control layer (MAC). The CID identifies a connection to equivalent peers in the MAC of the base station and subscriber station.

Example: `"BB:WIM:OFDM:BURS2:MAC:CID #HE7"` 'sets the CID for burst 2 to 231.

*RST value	Resolution	Options	SCPI
0	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:MAC:CRC:STATe ON | OFF

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:MAC:CRC:STATe ON | OFF

The command activates/deactivates the checksum determination. The state of the CRC can be set independently of the state of MAC header generation.

Example: "BB:WIM:OFDM:BURS2:MAC:CRC:STAT ON"
'activates the checksum determination for burst 2.

*RST value	Resolution	Options	SCPI
OFF	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:MAC:EKS 0 ... 4

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:MAC:EKS 0 ... 4

The command sets the EKS (encryption key sequence) value in the MAC header. The payload encryption itself is not performed by the signal generator.

Example: "BB:WIM:OFDM:BURS2:MAC:ENCR:STAT ON" 'enables payload encryption

"BB:WIM:OFDM:BURS2:MAC:EKS 2" 'sets the EKS for burst 2.

*RST value	Resolution	Options	SCPI
0		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:MAC:ENCRypted:STATe ON | OFF

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:MAC:ENCRypted:STATe ON | OFF

The command activates/disactivates payload encryption. If activated, the EC (encryption control) field is set to 1 and the EKS (encryption key sequence) field can be set.

Example: "BB:WIM:OFDM:BURS2:MAC:ENCR:STAT ON"
'enables payload encryption for burst 2

"BB:WIM:OFDM:BURS2:MAC:EKS 2" 'sets the EKS.

*RST value	Resolution	Options	SCPI
OFF		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:MAC:STATe ON | OFF

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:MAC:STATe ON | OFF

The command enables/disables generation of the generic MAC header for the selected burst.

Example: "BB:WIM:OFDM:BURS2:MAC:STAT ON"
'enables generation of the generic MAC header for burst 2

*RST value	Resolution	Options	SCPI
OFF		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:MAC:TYPE #H0,0...#H40,6

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:MAC:TYPE #H0...#H3F

The command specifies the MAC type..The value of the 6-bit type field is set which indicates the payload type, including the presence of subheaders.

Example: "BB:WIM:OFDM:BURS2:MAC:TYPE #H3F"
'sets the type field of the MAC header of burst 2.

*RST value	Resolution	Options	SCPI
#H0		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:MIDamble OFF | REP5 | REP9 | REP17

The command activates/deactivates midamble repetition. If midamble repetition is switched on, midambles are placed into the burst with the specified interval, i.e. if 5 is selected, every 5th symbol of the burst is a midamble.

The midambles are identical to the burst preamble, that means a short preamble is used as midamble when subchannelization is off or a subchannelization preamble is used in subchannelization mode. The uplink burst preamble is always generated, even if midambles are switched off. The power of the midambles is identical to the burst power.

The command is available in uplink only.

Example: "BB:WIM:LINK UP" 'selects transmission direction uplink.

"BB:WIM:OFDM:BURS2:MID REP9"
'the midamble is repeated each 9th symbol of burst 2.

*RST value	Resolution	Options	SCPI
OFF	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:OFFSet:MODE USER | AUTO

The command selects the offset mode for the selected burst. The offset mode determines if the subchannel offset and the symbol offset of each burst are set automatically or manually.

Example: `"BB:WIM:AOFD:BURS2:OFFS:MODE USER"`
'sets the manual offset mode. The start subchannel and symbol of the burst are set manually with commands `BB:WIM:AOFD:BURS:OFFS:SUBChannel` and `BB:WIM:AOFD:BURS:OFFS:SYMBol`.

*RST value	Resolution	Options	SCPI
AUTO		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:OFFSet:SUBChannel 0 ... 4 294 967 295

The command sets the subchannel offset for the selected burst. This command is only available for offset mode user (`BB:WIM:AOFD:BURS2:OFFS:MODE USER`)

Example: `"BB:WIM:AOFD:BURS2:OFFS:MODE USER"`
'sets the manual offset mode.

`"BB:WIM:AOFD:BURS2:OFFS:SUBC 8"`
'selects subchannel 8 as start subchannel for burst 2.

*RST value	Resolution	Options	SCPI
Burst0: 7 All other bursts: 0		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:OFFSet:SYMBol 3 ... 1000

The command sets the symbol offset for the selected burst. This command is only available for offset mode user (`BB:WIM:AOFD:BURS2:OFFS:MODE USER`)

Example: `"BB:WIM:AOFD:BURS2:OFFS:MODE USER"`
'sets the manual offset mode.

`"BB:WIM:AOFD:BURS2:OFFS:SYMB 2"`
'selects symbol 2 as start symbol for burst 2.

*RST value	Resolution	Options	SCPI
0		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:POWer -80 dB ... +10 dB

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:POWer -80 dB ... +10 dB

The command sets the power for the selected burst in dB. To set the absolute power of a burst correctly, level reference "**FCH / Burst**" must be selected. In this mode, the output power of a burst equals Level + BurstPower.

In downlink, the preamble is transmitted with +3dB and the FCH is transmitted with 0dB.

In uplink, the power of the first burst is fixed to 0dB.

Example: `"BB:WIM:OFDM:BURS2:POW -2 dB"` 'sets the burst power to -2dBs.

*RST value	Resolution	Options	SCPI
0	0.01 dB	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:PREamble:STATe ON | OFF

The command enables/disables generation of the preamble for the selected burst. This command is only available for downlink transmission.

Example: `"BB:WIM:LINK DOWN"` 'selects downlink transmission.

`"BB:WIM:OFDM:BURS2:PRE:STAT ON"`
'enables generation of the preamble for burst 2

*RST value	Resolution	Options	SCPI
OFF		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:SLOT:COUNt 2 ... 1000

The command sets the number of slots for the selected burst. If the number of slots is changed, the data length is adjusted to fill the specified number of slots with data so that no padding has to be applied.

The maximum data length of 10 000 bytes defines the maximum number of symbols for a given modulation type and channel coding rate.This command is available in uplink only.

Example: `"BB:WIM:AOFD:BURS2:SLOT:COUN 12"` 'sets 2 slots for burst 2.

*RST value	Resolution	Options	SCPI
1		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:SUBChannel[:COUNt] 1 ... 1000

The command sets the number of subchannels for the selected burst. If the number of subchannels is changed, the data length is adjusted to fill the specified number of symbols with data so that no padding has to be applied.

The maximum data length of 10 000 bytes defines the maximum number of symbols for a given modulation type and channel coding rate.

For physical layer mode OFDMA, this command is available in downlink only.

Example: `"BB:WIM:OFDM:BURS2:SUBC 16"` 'sets 16 subchannels for burst 2.

*RST value	Resolution	Options	SCPI
1		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BURSt<0...7>:SYMBol[:COUNt] 1 ...1000

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:SYMBol[:COUNt] 1 ... 834

The command sets the number of symbols for the selected burst. If the number of symbols is changed, the data length is adjusted to fill the specified number of symbols with data so that no padding has to be applied.

The maximum data length of 10 000 bytes defines the maximum number of symbols for a given modulation type and channel coding rate.

Example: `"BB:WIM:OFDM:BURS2:SYMB 12"` 'sets 12 symbols for burst 2.

*RST value	Resolution	Options	SCPI
9		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:OFDM:BURSt<0...7>:UIUC 0 ... 15

The command sets the specific interval usage code for an uplink. The code is used to initialize the randomizer.

Example: `"BB:WIM:OFDM:BURS2:UIUC 12"`
'sets Uplink Interval Usage Code12 for burst 2.

*RST value	Resolution	Options	SCPI
1		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:BW 1.25 to 28 MHz.

[SOURce<[1]|2>:]BB:WIMax:OFDM:BW 1.25 to 28 MHz

The command sets the channel bandwidth. The selected channel bandwidth has to be a multiple of 1.25, 1.5, 1.75, 2.0 or 2.75 MHz. The channel bandwidth determines the parameter n (sampling ratio, command `SOUR:BB:WIMax:OFDM:N`). The sampling rate is derived from the channel bandwidth as follows:

SamplingRate = floor(n * ChannelBandwidth / 8000) * 8000

Downlink: The allowed values depend on the selected frequency band (command `SOUR:BB:WIMax:OFDM:FBAN`). Only discrete sets of values are available. If a new value is not allowed, the next allowed value in the direction of change is set.

Uplink: The full range between 1.25 and 28 MHz is available. Only discrete sets of values are available. If a new value is not allowed, the next allowed value in the direction of change is set.

Example: 14 MHz and 28 MHz are allowed, the current value is 14 MHz. If a new value of 15 MHz is entered it is changed to 28 MHz.

Example:
```
"BB:WIM:OFDM:FBAN ETSI"   'selects frequency band according to ETSI specifications.
"BB:WIM:OFDM:BW 7E6"      'sets the channel bandwidth to 7 MHz.
```

*RST value	Resolution	Options	SCPI
1.75 MHz	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:BSID #H0,0 ... #HFFFFFFFFFFFF,48

The command sets the 4 LSBs of the Base Station ID.. Only the four least significant bits are given. The BSID is transmitted in the FCH (when set to **Auto** mode), and it is used to initialize the randomizer.).This command is available in downlink only and for DL-MAP Mode Auto (`BB:WIM:AOFD:DLM:MODE AUTO`).

Example:
```
"BB:WIM:OFDM:BSID 2"      'the base station id is 2.
```

*RST value	Resolution	Options	SCPI
#H0,0	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:DCD[:COUNt] 0 ... 255

The command sets the DCD Count. This value is used for the corresponding DL-MAP field in Auto mode. This command is available in downlink only and for DL-MAP Mode Auto (`BB:WIM:AOFD:DLM:MODE AUTO`).

Example:
```
"BB:WIM:AOFD:DLM:DCD 2"   'sets the DCD count to 2.
```

*RST value	Resolution	Options	SCPI
0	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:DATA ZERO | ONE | PATTern | PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | DLISt

The command determines the data source for the data fields of the downlink map.

This command is available in downlink only and for DL-MAP Mode User (`BB:WIM:AOFD:DLM:MODE` USER).

Parameters:

PNxx The pseudo-random sequence generator is used as the data source. Different random sequence lengths can be selected.

DLISt A data list is used. The data list is selected with the command `:BB:WIMax:AOFD:DLM:DATA:DSELect`.

ZERO | ONE Internal 0 and 1 data is used

PATTern Internal data is used The bit pattern for the data is defined by the command `:BB:WIMax:AOFD:DLM:DATA:PATTern`.

Example:

```
"BB:WIM:AOFD:DLM:DATA PATT"
```
'selects as the data source for the downlink map, the bit pattern defined with the following command.

```
"BB:WIM:AOFD:DLM:DATA:PATT  #H3F,8"
```
'defines the bit pattern.

*RST value	Resolution	Options	SCPI
PN9	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:DATA:DSELect <data list name>

The command selects the data list for the DLISt data source selection.

The lists are stored as files with the fixed file extensions ***.dm_iqd** in a directory of the user's choice. The directory applicable to the following commands is defined with the command `MMEMory:CDIR`. To access the files in this directory, you only have to give the file name, without the path and the file extension.

This command is available in downlink only and for DL-MAP Mode User (`BB:WIM:AOFD:DLM:MODE` USER).

Example:

```
"BB:WIM:AOFD:DLM:DATA DLIS"
```
'selects the Data Lists data source.

```
"MMEM:CDIR 'D:\Lists\DM\IqData'"
```
'selects the directory for the data lists.

```
"BB:WIM:AOFD:DLM:DATA:DLIS 'wimax_dlmap1'"
```
'selects file 'wimax_dlmap1' as the data source. This file must be in the directory `D:\Lists\DM\IqData` and have the file extension *.dm_iqd.

*RST value	Resolution	Options	SCPI
-	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:DATA:PATTern #B0,1... #B111..1,64

The command determines the bit pattern for the PATTern selection. The maximum length is 64 bits.

This command is available in downlink only and for DL-MAP Mode User (`BB:WIM:AOFD:DLM:MODE USER`).

Example: `"BB:WIM:AOFD:DLM:DATA:PATT #H3F,8"` 'defines the bit pattern.

*RST value	Resolution	Options	SCPI
0	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:FNOFfset 0 ... 16777215

The command sets the frame number offset of the DL map. This value is added to the current frame number of the sequence. The result is used as Frame Number in the DL-MAP (in Auto mode).

This command is available in downlink only and for DL-MAP Mode Auto (`BB:WIM:AOFD:DLM:MODE AUTO`).

Example: `"BB:WIM:AOFD:DLM:FNOF 12"` 'sets a frame number offset of 2 frames

*RST value	Resolution	Options	SCPI
0	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:LENGth 0 ... 10 000 Bytes

The command sets the length of the DL map in bytes.

Example: `"BB:WIM:AOFD:BURS:DATA DLIS"`
'selects the Data Lists data source.

`"MMEM:CDIR 'D:\Lists\DM\IqData'"`
'selects the directory for the data lists.

`"BB:WIM:AOFD:BURS:DATA:DLIS 'wimax_list1'"`
'selects file '`wimax_list1`' as the data source. This file must be in the directory `D:\Lists\DM\IqData` and have the file extension *.dm_iqd.

*RST value	Resolution	Options	SCPI
-	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:MODE USER | AUTO

The command selects the mode for configuration of the DL map. Depending on this setting the above commands are available.

This command is available in downlink only.

Parameter:

AUTO The DL-MAP is filled automatically with parameters specified at different locations. The mapping that applies in Auto mode is described in in the chapter 4, section "*DL-MAP Configuration Downlink OFDMA - WiMAX*", page 28.

USER The DL-MAP is filled with data specified under Data Source. This enables any arbitrary data to be sent with the DL-MAP burst.

Example: `"BB:WIM:AOFD:DLM:MODE AUTO"` The DL-MAP is filled automatically.

*RST value	Resolution	Options	SCPI
AUTO	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:REPCoding RC0 | RC2 | RC4 | RC6

The command sets activates/deactivates repetition coding. Setting RCO deactivates, all other settings activate repetition coding.

Example: `"BB:WIM:AOFD:DLM:REPC RC2"` 'activates repetition coding

*RST value	Resolution	Options	SCPI
RC0	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:DLMap:STATe ON | OFF

The command activates/disactivates the use of the DL map. If activated, .

This command is available in downlink only.

Example: `"BB:WIM:AOFD:DLM:STAT ON"` switches DL-MAP on

*RST value	Resolution	Options	SCPI
ON	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:FBANd ETSI | MMDS | WCS | UNII | USER

[SOURce<[1]|2>:]BB:WIMax:OFDM:FBANd ETSI | MMDS | WCS | UNII | USER

The command selects the available frequency band for the carrier frequencies.

Parameter:

ETSI The frequency band as defined by the **European Telecommunications Standards Institute** applies. The range is 1.75 to 28 MHz for the channel bandwidth and 2 to 32 MHz for the sampling rate.

MMDS The frequency band as defined by the **Multichannel Multipoint Distribution Service** applies. The RF frequency range is 2500 to 2686 MHz. The range is 1.50 to 24 MHz for the channel bandwidth and 1.72 to 27.52 MHz for the sampling rate.

WCS The frequency band as defined by the **Wireless Communication Service** applies. It is in the 2.3 GHz band of the electromagnetic spectrum from 2305 to 2320 MHz and 2345 to 2360 MHz. The range is 2.5 to 15 MHz for the channel bandwidth and 2.88 to 17.28 MHz for the sampling rate.

UNII The frequency band as defined by the **Unlicensed National Information Infrastructure** applies. IIt is in the 5 GHz band of the electromagnetic spectrum from 5150 to 5350 GHz and 5750 to 5825 GHz. The range is 10 to 20 MHz for the channel bandwidth and 11.52 to 23.04 MHz for the sampling rate.

USER This mode is provided for choosing any other channel bandwidth / sampling rate combination. The range is 1.25 to 28 MHz for the channel bandwidth and 1.44 to 32 MHz for the sampling rate.

Example: `"BB:WIM:OFDM:FBAN ETSI"` 'selects frequency band according to ETSI specifications

*RST value	Resolution	Options	SCPI
ETSI	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:OFDM:FCH:CCC 1 ... 15

The command sets the configuration change count value. This value is used for the corresponding FCH field in **Auto** mode (`SOURce:BB:WIMax:OFDM:FCH:MODE AUTO`).

Example: `"BB:WIM:OFDM:FCH:CCC 4"` 'sets configuration change count value to 4.

*RST value	Resolution	Options	SCPI
0	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:FCH:DATA
PN9 | PN15 | PN16 | PN20 | PN21 | PN23 | DLISt | ZERO | ONE | PATTern | USB

[SOURce<[1]|2>:]BB:WIMax:OFDM:FCH:DATA
PN9 | PN15 | PN16 | PN20 | PN21 | PN23 | DLISt | ZERO | ONE | PATTern | USB

The command specifies the data source in **User** mode (`SOURce:BB:WIMax:OFDM:FCH:MODE AUTO`). The FCH contents are filled from the selected data source.

Parameters:

PNxx The pseudo-random sequence generator is used as the data source. Different random sequence lengths can be selected.

DLISt A data list is used. The data list is selected with the command `:BB:WIMax:OFDM:FCH:DATA:DSELect`.

ZERO | ONE Internal 0 and 1 data is used

PATTern Internal data is used The bit pattern for the data is defined by the command `:BB:WIMax:OFDM:FCH:DATA:PATTern`.

USB The data is supplied externally via the USB interface.

Example:

```
"BB:WIM:OFDM:FCH:DATA PATT"
```
'selects as the data source for the data fields of FCH, the bit pattern defined with the following command.

```
"BB:WIM:OFDM:FCH:DATA:PATT  #H3F,8"
```
'defines the bit pattern.

*RST value	Resolution	Options	SCPI
PN9	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDn:FCH:DATA:DSELect <data list name>

[SOURce<[1]|2>:]BB:WIMax:OFDM:FCH:DATA:DSELect <data list name>

The command selects the data list for the DLISt data source selection.

The lists are stored as files with the fixed file extensions ***.dm_iqd** in a directory of the user's choice. The directory applicable to the following commands is defined with the command `MMEMory:CDIR`. To access the files in this directory, you only have to give the file name, without the path and the file extension.

This command is available only in **User** mode (`SOURce:BB:WIMax:OFDM:FCH:MODE AUTO`).

Example: `"BB:WIM:OFDM:FCH:DATA DLIS"`
'selects the Data Lists data source.

`"MMEM:CDIR 'D:\Lists\DM\IqData'"`
'selects the directory for the data lists.

`"BB:WIM:OFDM:FCH:DATA:DLIS 'wimax_list1'"`
'selects file '`wimax_list1`' as the data source. This file must be in the directory `D:\Lists\DM\IqData` and have the file extension *.dm_iqd.

*RST value	Resolution	Options	SCPI
-	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:FCH:DATA:PATTern
#B0,1... #B111..1,64

[SOURce<[1]|2>:]BB:WIMax:OFDM:FCH:DATA:PATTern
#B0,1... #B111..1,64

The command determines the bit pattern for the PATTern selection. The maximum length is 64 bits.

This command is available only in **User** mode (`SOURce:BB:WIMax:OFDM:FCH:MODE AUTO`).

Example: `"BB:WIM:OFDM:BURS:DATA:PATT #H3F,8"` 'defines the bit pattern.

*RST value	Resolution	Options	SCPI
0	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:OFDM:FCH:FNOFfset 1 ... 15

The command sets the frame number offset. This value is added to the current frame number of the sequence. After modulo 16 division, the result is used as Frame_Number in the FCH (in Auto mode) and is also used to initialize the randomizers.

Example: `"BB:WIM:OFDM:FCH:FNOF 4"`
'sets a frame number offset of 4.

*RST value	Resolution	Options	SCPI
0	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:FCH:MODE AUTO | USER

[SOURce<[1]|2>:]BB:WIMax:OFDM:FCH:MODE AUTO | USER

The command selects the mode for generating the FCH.Channel Coding of the FCH is performed both in **Auto** and **User** mode.

Parameter:

AUTO The DLFP fields, which form the FCH, are filled automatically with parameters specified at different locations. The following mapping applies in Auto mode:

Base_Station_ID:	Set to the BSID value specified in the frame configuration menu.
Frame_Number:	Set to the current frame number modulo 16. The first frame of the generated sequence has the number specified in Frame Number Offset below. For the following frames, this number will increase by 1 per frame.
Configuration_Change_Count:	Set to the value specified below.
Rate_ID:	The Rate ID parameter of the first burst is set according to its modulation setting.
DIUC:	The DIUC value for the second, third and fourth burst is taken from the DIUC value in the burst table.
Preamble Present:	Set to 1 when the burst preamble is activated for the corresponding burst.
Length:	Set to the calculated number of symbols of the corresponding burst.
HCS:	The Header Check Sequence is automatically calculated.

USER the FCH is filled with data specified under Data Source. This enables any arbitrary data to be sent with the FCH burst.

Example: `"BB:WIM:OFDM:FCH:MODE AUTO"`
'selects FCH mode AUTO.

*RST value	Resolution	Options	SCPI
AUTO	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:FCH:STATe ON | OFF

[SOURce<[1]|2>:]BB:WIMax:OFDM:FCH:STATe ON | OFF

The command switches the FCH on or off.

Example: "BB:WIM:OFDM:FCH:STAT OFF" 'switches off generation of FCH.

*RST value	Resolution	Options	SCPI
ON	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:FFT FFT128 | FFT512 | FFT1024 | FFT2048

[SOURce<[1]|2>:]BB:WIMax:OFDM:FFT FFT256

The command sets the size of the fast fourier transform. For OFDM channels, the size is fixed to 256. For OFDMA configuration, the possible configurations of the subchannel map depend on the selected FFT size.

Example: "BB:WIM:OFDM:FFT?" 'queries the FFT size

Response: "FFT256" 'the FFT size is 256

*RST value	Resolution	Options	SCPI
OFDMA: FFT2048 OFDM: FFT256	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:OFDM:FRAMe:PREDefined USER | FBPSK12SHORT | FBPSK12MID | FBPSK12LONG | FQPSK12SHORT | FQPSK12MID | FQPSK12LONG | FQPSK34SHORT | FQPSK34MID | FQPSK34LONG | F16QAM12SHORT | F16QAM12MID | F16QAM12LONG | F16QAM34SHORT | F16QAM34MID | F16QAM34LONG | F64QAM23SHORT | F64QAM23MID | F64QAM23LONG | F64QAM34SHORT | F64QAM34MID | F64QAM34LONG

The command selects predefined setting for the frames.

Parameter:

USER The settings for the frame can be defined by the user.

F... Predefined settings for receiver testing are selected. The parameter includes the modulation, the channel coding rate and the test message type (long, short or middle). See IEEE 802.16-2004, section 8.3.11 for details.

Example: "BB:WIM:LINK UP" 'selects transmission direction uplink.

"BB:WIM:OFDM:FRAM:PRED FBPSK12LONG"
'selects predefined settings with BPSK modulation, channel coding 1 / 2 and long test message.

*RST value	Resolution	Options	Dependencies	SCPI
USER	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	All commands concerning the frame configuration are preset	Device-specific

[SOURce<[1]|2>:]BB:WIMax:OFDM:FRAMe[:NUMBer] 0 ... 15

The command selects the frame number of the uplink frame in which the UL map that specifies the uplink burst was transmitted.

This command is available in uplink only.

Example: `"BB:WIM:LINK UP"` 'selects transmission direction uplink.

`"BB:WIM:MODE OFDM"` 'selects OFDM physical layer mode.

`"BB:WIM:OFDM:FRAM 15"` 'selects frame number 15.

*RST value	Resolution	Options	SCPI
0	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:IDCell 0 ... 64

The command selects the id cell. In the first downlink zone, IDcell is used as DL_PermBase parameter for the permutation equations and partly sets the subcarrier randomizer initialisation vector. The uplink alias command is `SOURce:BB:WIMax:AOFDm:ULID`.

Example: `"BB:WIM:AOFD:IDC 4"` 'sets ID cell 4

*RST value	Resolution	Options	SCPI
0	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:N

[SOURce<[1]|2>:]BB:WIMax:OFDM:N

The command queries the factor n (sampling ratio). The sampling ratio is determined by the channel bandwidth (see parameter **Channel Bandwidth**)

The command is a query and therefore does not have an *RST value.

Example: `"BB:WIM:OFDM:N?"` 'queries the factor n

Response: `"N8D7"` 'the factor n is 8/7.

*RST value	Resolution	Options	SCPI
-	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:POWer:REFerence RMS | PREamble

The command selects the level reference.

Parameter:

RMS The instrument's level setting refers to the mean power of the subframe.

PREamble The instrument's level setting refers to the preamble, which is FCH / Burst power + 3dB (downlink only).

Example:

```
"BB:WIM:MODE AOFD"          'selects physical layer mode OFDMA.
"BB:WIM:LINK DOWN"          'select transmission direction downlink.
"BB:WIM:AOFD:POW:REF PRE"   'the instrument's level setting refers to the preamble.
```

*RST value	Resolution	Options	SCPI
BURSt	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:OFDM:POWer:REFerence BURSt | PREamble

The command selects the level reference.

Parameter:

BURSt The instrument's level setting refers to the mean power of FCH or bursts with a burst power setting of 0 dB. To obtain the absolute burst power value, the burst power value has to be added to the level value.

PREamble The instrument's level setting refers to the preamble, which is FCH / Burst power + 3dB.

Example:

```
"BB:WIM:OFDM:POW:REF BURS"  'the instrument's level setting refers to the mean power of FCH or bursts with a burst power setting of 0 dB.
```

*RST value	Resolution	Options	SCPI
BURSt	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:PREamble:INDex 0 ... 113

The command selects the preamble index for the generation of a downlink frame preamble.

This command is available only in downlink and in **User** mode (`SOURce:BB:WIMax:AOFDM:PRE:IND:MODE USER`).

Example: `"BB:WIM:LINK DOWN"` 'selects downlink transmission.

`"BB:WIM:AOFD:PRE:IND 10"` 'selects preamble 10

*RST value	Resolution	Options	SCPI
0		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:PREamble:INDex:MODE AUTO | USER

The command selects the mode for selecting the preamble index..

This command is available only in downlink and in **User** mode (`SOURce:BB:WIMax:AOFDM:PRE:IND:MODE USER`).

Example: `"BB:WIM:LINK DOWN"` 'selects downlink transmission.

`"BB:WIM:AOFD:PRE:IND:MODE AUTO"`
'the preamble index for the generation of a downlink frame preamble is set automatically

*RST value	Resolution	Options	SCPI
AUTO		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:OFDM:PREamble:MODE OFF | LONG | SHORt

The command activates/deactivates the generation of a frame preamble (downlink) or burst preamble (uplink). Either a long preamble or a short preamble can be activated. The 802.16 standard requires a long preamble as frame start in the downlink. .

Example: `"BB:WIM:LINK DOWN"` 'selects downlink transmission.

`"BB:WIM:OFDM:PRE:MODE SHOR"`
'enables generation of a short preamble for the frame

*RST value	Resolution	Options	SCPI
Downlink: LONG Uplink: SHORt		B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:SCARrier:PERMutation PUSC | FUSC

The command selects the type of subcarrier permutation for OFDMA configurations.

Example: `"BB:WIM:AOFD:SCAR:PERM PUSC"`

*RST value	Resolution	Options	SCPI
FUSC	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:SRATe 1.44 MHz ... 32 MHz

[SOURce<[1]|2>:]BB:WIMax:OFDM:SRATe 1.44 MHz ... 32 MHz

The command sets the sampling rate. . The sampling rate is related to the channel bandwidth by the parameter n:

SamplingRate = floor(n * ChannelBandwidth / 8000) * 8000

Downlink:
The value range depends on the selected frequency band (command `SOUR:BB:WIMax:OFDM:FBAN`). Only discrete sets of values are available. If a new value is not allowed, the next allowed value in the direction of change is set.

Uplink:
The full range between 1.44 and 32 MHz is available. Only discrete sets of values are available. If a new value is not allowed, the next allowed value in the direction of change is set.

Example: 16 MHz and 32 MHz are allowed, the current value is 16 MHz. If a new value of 17 MHz is entered it is changed to 32 MHz.

Example: `"BB:WIM:OFDM:SRAT 2E6"` 'sets a sampling rate of 2 MHz

*RST value	Resolution	Options	SCPI
2 MHz	1 kHz	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:OFDM:SUBChannel[:COUNt] SC1 | SC2 | SC4 | SC8 | SC16

The command selects the number of subchannels für OFDM configurations.

Selection 16 (all) deactivates subchannelization and activates all possible carriers. The values 1, 2, 4 and 8 activate only a part of the available subcarriers, unused carriers are blanked.

Example: `"BB:WIM:OFDM:SUBC:COUN SC4"` 'selects 4 subchannels to be used.

*RST value	Resolution	Options	SCPI
16	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:OFDM:SUBChannel:INDex SUBC1 ... SUBC31

The command selects the subchannel index in subchannelization mode. The subchannel index determines the set of used subcarriers according to table 213 of IEEE 802.16-2004 standard.

Example: `"BB:WIM:OFDM:SUBC:IND SUBC4"` 'selects subchannel set 4 to be used

*RST value	Resolution	Options	SCPI
SUBC16	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:SUBChannel<0 ... 5>:MAP ON | OFF

The command activates /deactivates the selected set of subchannels. There are 6 sets of subchannels available 0 = 0...11; 1 = 12...19; 2 =20-31; 3 = 32 - 39; 4 = 40 ...51; 5 = 52 ... 59).This command is available only in uplink and for subchannel mode user (`BB:WIM:AOFD:SUBC:MODE` USER).

Example: `"BB:WIM:AOFD:SUBC2:MAP ON"` 'activates subchannel set 2 (i.e. subchannels 20 ... 30).

*RST value	Resolution	Options	SCPI
0	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:SUBChannel<n>:MODE ALL| USER

The command determines if all or selected sets of subchannels are activated. The sets of subchannel to be activated are selected with command `SOUR:BB:WIM:AOFD:SUBC2:MAP`.

Example: `"BB:WIM:AOFD:SUBC:MODE USER"` 'selects user mode for selecting the activated subchannels.

`"BB:WIM:AOFD:SUBC2:MAP ON"` 'activates generation of set subchannels 20 to 31.

*RST value	Resolution	Options	SCPI
ALL	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:SUBChannel<n>:PATTern #HF.., 72

The command determines the 'allocated subchannel bitmap'. The pattern is a 72 bit value.

This command is available in uplink only.

Example: "BB:WIM:AOFD:SUBC:PATT #HFFFFFFFFFFFFFFFF3F,72"
'determines the 'allocated subchannel bitmap'

*RST value	Resolution	Options	SCPI
#HFFFFFFFFFFFFFFFF3F,72	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:TGTB TGTB1D4 | TGTB1D8 | TGTB1D16 | TGTB1D32

[SOURce<[1]|2>:]BB:WIMax:OFDM:TGTB TGTB1D4 | TGTB1D8 | TGTB1D16 | TGTB1D32

The command selects the ratio of guard period to symbol period. This value sets the length of the cyclic prefix in fractions of the symbol period.

Example: "BB:WIM:OFDM:TGTB TGTB1D8" 'sets a ratio of 1 to 8

*RST value	Resolution	Options	SCPI
1D8	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:ULIDcell 0 ... 69

The command sets the PermBase parameter used in the permutation equations. In the uplink, UL_PermBase is used in the permutation equation and is mapped to the preamble IDcell parameter for the subcarrier randomizer initialisation vector. The downlink alias command is SOURce:BB:WIMax:AOFDm:IDCell.

Example: "BB:WIM:AOFD:ULID 3" 'selects UL_PermBase 3

*RST value	Resolution	Options	SCPI
0	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WIMax:AOFDm:ULZone:SYMBol[:COUNt] 3 ... 6

The command selects the number of symbols in UL zone for OFDMA configurations.The duration of uplink bursts can not exceed the specified number of symbols.

Example: "BB:WIM:AOFD:ULZ:SYMB 3" 'selects 3 symbols for UL zone

*RST value	Resolution	Options	SCPI
	-	B10/B11 and B13 K49 SOURce2 only with second option B10/B11	Device-specific

Digital Standard IEEE 802.11 WLAN

Introduction - Digital Standard WLAN

The R&S Vector Signal Generator provides you with the ability to generate signals in accordance with the Wireless LAN standards IEEE 802.11a, IEEE 802.11b and IEEE 802.11g.

The equipment layout for IEEE 802.11a-g WLAN signal generation includes the options Baseband Main Module (B13), Baseband Generator (B10/B11) and Digital Standard IEEE 802.11a-g WLAN (K48). B10 features a much larger ARB memory size than B11 (see data sheet). But apart from the memory size, both options have the same functionality and are installed alternatively.

In the case of two-path instruments, at least one more option, the Baseband Generator (B10/B11) is required to generate a IEEE 802.11a-g WLAN signal in the second path. With this option, a IEEE 802.11a-g WLAN signal can be defined on path B and then either be routed to path A or added to the path A signal with a settable frequency offset. Generating the IEEE 802.11a-g WLAND signal simultaneously on paths A and B requires an additional, second option, the (Digital Standard IEEE 802.11a-g WLAN (K48). With a full path B configuration with a second option (Baseband Main Module (B13) and an RF section (frequency option B20x), the IEEE 802.11a-g WLAN signal can be output at RF output B.

'IEEE 802.11' stands for a wireless LAN standard prepared by ANSI/IEEE Institute of Electrical and Electronics Engineers). A brief description of the standard is given in the following. For a detailed description see the corresponding ANSI/IEEE specifications.

In 1990, IEEE founded the work group 802.11 which issued a first version of the 802.11 standard in June 1997. This standard defines two transmission methods: an infrared interface and radio transmission in the ISM band around 2.4 GHz.
Radio transmission can alternatively be carried out via frequency hopping spread spectrum (FHSS) or direct sequence spread spectrum (DSSS).

Originally, two data transmission modes were defined for the DSSS method.

- 1 Mbps data rate with DBPSK modulation
- 2 Mbps data rate with DQPSK modulation

Both modes spread the information data sequence with an 11-chip Barker sequence, and operate with a chip rate of 11 Mcps.

In spring 1999, the standard was extended by an OFDM mode, 802.11a, in the 5 GHz band. Soon afterwards, in summer 1999, the DSSS mode was extended, too. This expansion to include the new data rates of 5.5 Mbps and 11 Mbps is defined in the 802.11b standard. A new modulation mode, complementary code keying (CCK), was introduced (see following sections).

Standard 802.11g issued in 2003 extends standard 802.11b with higher transmission rates. It includes the previous 802.11b standard and implements the OFDM transmission of standard 802.11a in the 2.4 GHz ISM band. In the physical layer, the packet structure and modulation format of the OFDM modes are identical in 802.11g and 802.11a, only different transmission frequencies are used.

The 802.11 wireless LAN standard is a packet-oriented method for data transfer. The data packets are transmitted and received on the same frequency in time division duplex (TDD), but without a fixed timeslot raster. An 802.11 component can only transmit or only receive packets at any particular time.

The R&S Vector Signal Generator simulates IEEE 802.11a-g WLAN at the physical on the physical layer. Two simulation modes are offered:
In the framed mode a sequence of data packets with the frame structure defined by the standard is generated. A MAC header and a frame check sequence can be activated. In the unframed time mode a non-packet-oriented signal without frame structure is generated, with the modulation modes and data rates defined by the IEEE 802.11.

The following list gives an overview of the options provided by the R&S Vector Signal Generator for generating a IEEE 802.11a-g WLAN signal:

- Physical Layer modes OFDM (IEEE.802.11a/g), and CCK/PBCC (IEEE.802.11b/g).
- Chip/Sample rate 20 Mcps (OFDM IEEE.802.11a/g), and 11 Mcps (CCK/PBCC IEEE.802.11b/g).
- PSDU bit rates 1Mbps, 2Mbps, 5.5Mbps and 11 Mbps (CCK/PBCC), 22Mbps (PBCC), 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24Mbps, 36 Mbps, 48 Mbps and 54 Mbps (OFDM).
- PSDU Modulation DBPSK,DQPSK and CCK/PBCC (CCK/PBCC) and BPSK,QPSK,16QAM or 64QAM (OFDM) (depending on specified PSDU bit rate).
- Data scrambling can be activated or deactivated (CCK/PBCC) and initial scrambler state can be set randomly or to a user-defined value (OFDM).
- Clipping for reducing the crest factor.

Physical Layer OFDM

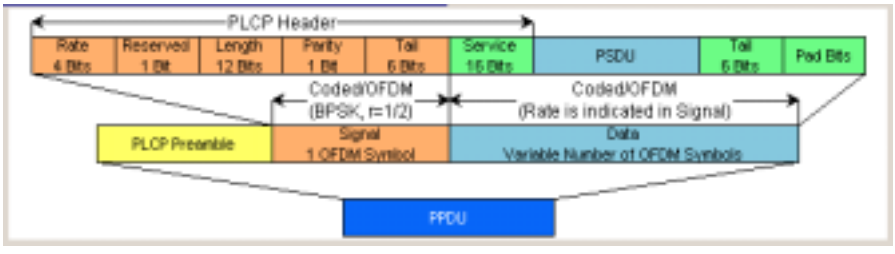
The standard defines OFDM (orthogonal frequency division multiplex) with 52 carriers as transmission method. The symbol rate of the modulation on the individual carriers is 250 kHz. A user data rate of up to 54 Mbps at a channel bandwidth of 20 MHz can be obtained by combining 48 useful carriers for data transmission (4 carriers are used for pilots) and using 64QAM for subcarrier modulation. With OFDM, the individual carriers are superimposed mutually orthogonal, which, in the ideal case, does not cause any intercarrier interference (ICI).

Table 4-1 Parameters of 802.11a/g OFDM modulation

Parameters	**Value**
Number of data subcarriers	48
Number of pilot subcarriers	4
Total of subcarriers used	52
Subcarrier frequency spacing	0.3125 MHz (= 20 MHz/64)
IFFT/FFT period	3.2 µs
Guard interval duration	0.8 µs (T_{FFT} /4)
Symbol interval	4 µs (T_{GI} + T_{FFT})
PLCP preamble duration	16 µs
Subcarrier modulation	BPSK OFDM QPSK OFDM 16QAM OFDM 64QAM OFDM
Error correction code	K = 7 (64 states) convolutional code
Code rates	1/2, 2/3, 3/4
Occupied bandwidth	16.6 MHz
Channel spacing	20 MHz

The table shows the main parameters of OFDM. 64-point IFFT is used to generate the 52 subcarriers. 12 of the 64 possible carriers are not used. One is the carrier in the middle of the band, which would otherwise be impaired by the carrier leakage of the I/Q modulator, the others are the remaining carriers at the upper and lower end of the spectrum. The required subcarrier offset of 312.5 kHz is implicitly observed when the time signal generated by the IFFT with a sampling rate of 20 MHz is output. These 20 MHz are also called 'kernel sample rate'. An OFDM symbol generated in this way would have a period of 3.2 µs. To compensate for multipath propagation, a so-called guard interval with a duration of 0.8 µs is attached to each symbol so that a total symbol interval of 4 µs is obtained.
Either BPSK, QPSK, 16QAM or 64QAM modulation can be used on the subcarriers. Prior to the modulation, the raw data are convolutionally coded with code rates of ½ to ¾ being possible.

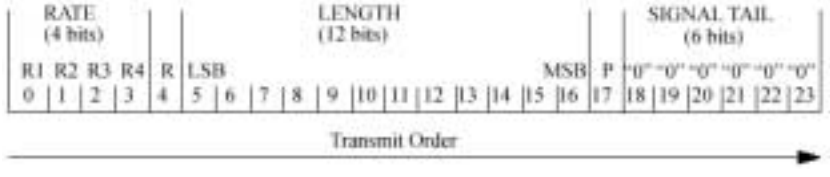
The frame structure can be seen in the figure below (also indicated in the **PPDU Configuration** submenu):



PLCP Format
The physical layer convergence protocol (PLCP) is a protocol layer between medium access control and the actual physical transmission layer (PHY). It is mainly used to adapt the different transmission formats of the 802.11 standards to the MAC layer which is identical for all transmission methods. Moreover, this protocol informs the receiver on the type of signal sent to allow for a correct demodulation.
The PLCP generates the PLCP protocol data unit (PPDU) frames which are physically transmitted.

PLCP Preamble
Each frame starts with the PLCP preamble made up of 10 short and 2 long symbols. The receiver uses the short symbols mainly for signal detection, AGC, coarse frequency adjustment and time synchronization. The long symbols are used to determine the transmission function of the channel and to set the equalizer of the receiver accordingly. The complete preamble is 16 µs long and thus corresponds to the duration of 4 normal OFDM symbols.

Signal Field
The signal field directly follows the preamble and consists of 24 bits which are used as follows:



The first 4 bits inform on the data rate (RATE) of the following data section. This allows the receiver to correctly set its demodulator. Following a reserved bit, 12 LENGTH bits are sent. They contain the number of bytes transmitted in this frame. After a parity bit, 6 tail bits reset the convolutional coder to zero.
With settings for 6 Mbps, the 24 bits are subjected to usual signal processing consisting of convolutional coding, interleaving, BPSK subcarrier modulation, pilot carrier generation and OFDM modulation and thus form exactly one OFDM symbol of 4 µs duration. Thanks to the use of the lowest data rate (6 Mbps), each receiver has the best chance to obtain the information required for subsequent demodulation of the data section.

User Data

The user data in the data section of the frame is finally taken to the receiver. The data section may have a variable length of OFDM symbols and can be transmitted with one of the defined data rates between 6 and 54 Mbps. The data section of the frame is subdivided into the fields SERVICE, PSDU, TAIL and Pad bits.

SERVICE 16 Bits	PSDU	TAIL 6 Bits	Pad Bits

The service field consists of 16 bits, the 7 LSBs transmitted first being 0. The allows the receiver to draw conclusions as to the start value of the scrambler in the transmitter. The remaining 9 bits are reserved and, according to the current version of the standard, should also be set to 0.

The PSDU may have a user-selectable length of up to 2346 bytes. 6 tail bits follow to reset the convolutional coder to zero. The data field must be filled with the full number of OFDM symbols and is therefore rounded up. Additional bits that may be available are set to 0 as pad bits.

A short description of the individual steps required to attain a valid 802.11a/g signal follows.

Data from the source (usually the next higher protocol layer, here MAC) must first be scrambled, i.e. multiplied with a PN sequence. A 127-bit code generated by the following generator polynomial is stipulated:

$$S(x) = x^7 + x^4 + 1$$

A feedback shift register generates the scrambling sequence. The start value of the register for the data section should be randomly selected.

A subsequent convolutional coder adds redundancies to the bits thus scrambled (factor of 2). The coder has 64 possible states (k = 7) and is described by the polynomials $g_0=133_8$ and $g_1=171_8$. To obtain the data rates of 6 to 54 Mbps defined by the standard, different channel code rates are required. Bits generated by the convolutional coder are therefore punctured (i.e. omitted) depending on the setting so that 1/2, 2/3 or 3/4 code rates are attained. Increasing the redundancy by channel coding is generally mandatory in case of OFDM modulations since complete subcarriers may be eliminated by frequency selective fading so that the loss of bits on the transmission path is in many cases unavoidable.

To increase the performance of the convolutional coder, the coded data are interleaved in the next step. Two interleaver stages ensure that the adjacent bits of the convolutional coder are first distributed to different subcarriers and then to higher- or lower-significant bits of the constellation used for subcarrier modulation. Long sequences of defective bits can thus be avoided which significantly improves the faculties of the Viterbi decoder in the receiver for a correction.

The next stage performs the actual modulation of the individual OFDM carriers. Depending on the set data rate, the useful carriers are subjected to a uniform BPSK, QPSK, 16QAM or 64QAM modulation. This is done by first calculating the I and Q coefficients of each carrier. Gray coding is used to distribute the data bits to constellation points. All carriers from -26 to +26, except carriers -21, -7, 0, 7 and 21, are used for the transmission of user data. Carrier number 0 (directly at the center frequency later on) is not used and is always 0. The remaining 4 are BPSK-modulated pilots. The pilot carriers change their phase with each symbol. The phase variation is determined by the 127-bit PN sequence already defined as scrambling sequence.

The actual OFDM modulation is performed by inverse discrete Fourier transform (IFFT) in the next step. A 64-point IFFT is carried out with the I and Q coefficients of the subcarriers obtained before. To ensure sufficient spacing of aliasing products, only 52 of the 64 possible carriers are used. The result is a discrete complex time signal in the baseband with modulated OFDM carriers. A guard field which corresponds to a periodic continuation of the same symbol is then appended before each OFDM symbol. Multipath propagation can thus be easily compensated in the receiver.

Aliasing products are suppressed by oversampling, converting the discrete digital signal to an analog signal and subsequent filtering. In the last step, the baseband signal is modulated onto the selected RF carrier and the complete signal is sent to the receiver via the air interface.

Physical Layer CCK-PBCC

A distinction is made between the packet type (or PPDU format) with long or short PLCP (physical layer convergence protocol).

Long PLCP PPDU Format
In 802.11, the data packet on the physical layer is referred to as PPDU (PLCP protocol data units). A PPDU consists of three components; the PLCP preamble, the PLCP header and the PSDU (PLCP service data unit), which contains the actual information data (coming from higher layers).
The PLCP preamble and header are used for synchronization and signalling purposes, and are themselves divided into fields.

The **PLCP preamble** consists of a synchronization field and a start frame delimiter field. The standard specifies a fixed data content for both fields.

The **PLCP header** consists of the signal, service, length and CRC fields.
The signal field determines the data rate used in the PSDU field. The rates 1 Mbps, 2 Mbps, 5.5 Mbps, and 11 Mbps can be selected; rates 22 MBps and 33 Mbps can be used in the optional PBCC modes.
The service field also helps to differentiate the modulation modes (CCK or PBCC) used for the higher data rates of 5.5 Mbps and 11 Mbps.
The length of the PSDU field is entered in µs in the Length field.
The CRC field contains a check sum of all the fields of the PLCP header.

The PLCP preamble and the PLCP header in the long PLCP PPDU format are both DBPSK-modulated and transmitted at a data rate of 1 Mbps. The data rate and the modulation of the PSDU component are defined by the signal and service fields in the PLCP header.

The frame structure can be seen in the figure below (also indicated in the **PPDU Configuration** submenu):

Short PLCP PPDU Format
The basic structure of the short PLCP PPDU format is identical to that of the long PLCP PPDU format. There is no difference in the PSDU component. The PLCP preamble and header are generated in an abbreviated form. In the short preamble, the number of bits transmitted in the SYNC field is reduced from 128 to 56. In the short header, however, the number of data bits transmitted remains unchanged, but the data rate is doubled (to 2 Mbps). These measures halve the transmission periods of preamble and header in the short PLCP format, as compared to the long PLCP format.

The frame structure can be seen in the figure below (also indicated in the **PPDU Configuration** submenu):

Data Spreading and Modulation CCK-PBCC

The Vector Signal Generator simulates signals in accordance with 802.11 on the physical layer. In the standard, the data link layer or, to be more precise, the MAC sublayer provides the input data for this layer The following graph illustrates the signal generation process in WinIQSIM.

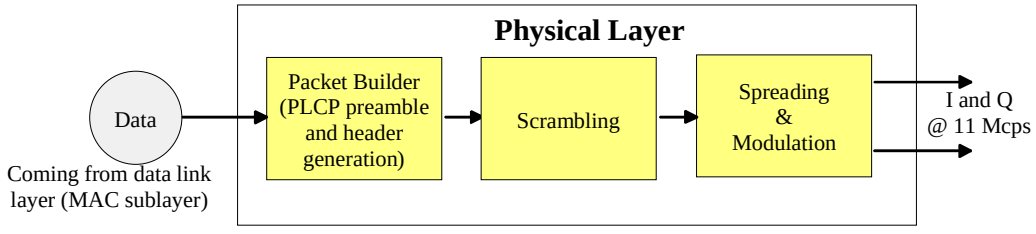


Fig. 4-1 Principle of 802.11b/g signal generation

Depending on the PLCP PPDU format used, the PLCP preamble and the PLCP header are combined in the packet builder. The PSDU field of the packet is filled with the input data of the physical layer block. In the next step, all the packet data is scrambled. The actual spreading and modulation of the data signal to the resulting chip rate of 11 Mcps comes next.
However, the data rates and modulations of the individual fields of a packet can differ. The PLCP preamble always has a data rate of 1 Mbps, and is DBPSK-modulated. Besides the actual modulation, spreading to the resulting chip rate occurs.
The PLCP header is either treated exactly like the preamble (long PLCP PPDU format), or DQPSK-modulated at a data rate of 2 Mbps (short PLCP PPDU format). Data rates (1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps, etc) with different modulations can be used for the data part of the packet, the PLCP service data unit (PSDU). The following table gives an overview of the different combinations of data rates, modulations and spreading/coding methods.

Packet field	Data rate	Chip rate	Spreading/coding methods	Modulation
Short PLCP preamble	1 Mbps	11 Mcps	11-chip Barker sequence	DBPSK
Long PLCP preamble	1 Mbps	11 Mcps	11-chip Barker sequence	DBPSK
Short PLCP header	2 Mbps	11 Mcps	11-chip Barker sequence	DQPSK
Long PLCP header	1 Mbps	11 Mcps	11-chip Barker sequence	DBPSK
PSDU	1 Mbps (long PPDU)	11 Mcps	11-chip Barker sequence	DBPSK
PSDU	2 Mbps	11 Mcps	11-chip Barker sequence	DQPSK
PSDU	5.5 Mbps	11 Mcps	CCK	DQPSK
PSDU	11 Mbps	11 Mcps	CCK	DQPSK
PSDU	5.5 Mbps	11 Mcps	PBCC	BPSK
PSDU	11 Mbps	11 Mcps	PBCC	QPSK
PSDU	22 Mbps	11 Mcps	PBCC	8PSK
PSDU	33 Mbps	16.5 Mcps	PBCC	8PSK

The individual combinations of spreading, coding and modulation are described below.

1 Mbps Data Rate with DBPSK Modulation

At a data rate of 1 Mbps, the already scrambled data stream is DBPSK-modulated according to the table below. The resulting symbol sequence is then spread using the 11-chip Barker sequence.

Bit input	Phase change (+jω)
0	0
1	π

2 Mbps Data Rate with DQPSK Modulation

At a data rate of 2 Mbps, the already scrambled data stream is DQPSK-modulated according to the table below. The resulting symbol sequence is then spread using the 11-chip Barker sequence.

Dibit pattern (d0,d1) (d0 is first in time)	Phase change (+j∞)
00	0
01	π/2
11	π
10	3π/2 (−π/2)

5.5 Mbps Data Rate with CCK Modulation

The standard specifies CCK modulation (complementary code keying) for a data rate of 5.5 Mbps. To this end, in each modulation step, four successive bits (d_0 to d_3) are taken from the data stream which is already scrambled. The phases $\varphi_1, \varphi_2, \varphi_3, \varphi_4$ are determined by these four bits. φ_1 is determined by the data bits d_0 and d_1 according to the following table, which specifies different phases for even and odd modulation steps:

Dibit pattern (d0, d1) (d0 is first in time)	Even symbols phase change (+j∞)	Odd symbols phase change (+j∞)
00	0	π
01	π/2	3π/2 (−π/2)
11	π	0
10	3π/2 (−π/2)	π/2

The phase φ_1 must be interpreted relative to the phase of the previous symbol.

The other three phases are determined as follows:

$$\varphi_2 = (d_2 \cdot \pi) + \pi/2$$

$$\varphi_3 = 0$$

$$\varphi_4 = d_3 \cdot \pi$$

By means of these four phases, the CCK code word can now be determined; it is:

$$c = \{e^{j(\varphi_1+\varphi_2+\varphi_3+\varphi_4)}, e^{j(\varphi_1+\varphi_3+\varphi_4)}, e^{j(\varphi_1+\varphi_2+\varphi_4)}, -e^{j(\varphi_1+\varphi_4)}, e^{j(\varphi_1+\varphi_2+\varphi_3)}, e^{j(\varphi_1+\varphi_3)}, -e^{j(\varphi_1+\varphi_2)}, e^{j\varphi_1}\}$$

Example:

(d_0 to d_3) = (0110), the phase of the last symbol is 0, the current modulation step is even:

$$\varphi_1 = \pi/2$$

$$\varphi_2 = (1 \cdot \pi) + \pi/2 = 3\pi/2$$

$$\varphi_3 = 0$$

$$\varphi_4 = 0 \cdot \pi = 0$$

The CCK code word is consequently:

$$c = \left(e^{j(\pi/2+3\pi/2+0+0)}, e^{j(\pi/2+3\pi/2+0)}, e^{j(\pi/2+3\pi/2+0)}, -e^{j(\pi/2+0)}, e^{j(\pi/2+3\pi/2+0)}, e^{j(\pi/2+0)}, -e^{j(\pi/2+3\pi/2)}, e^{j\pi/2},\right)$$

$$c = \left(e^{j0}, e^{j0}, e^{j0}, -e^{j\pi/2}, e^{j0}, e^{j\pi/2}, -e^{j0}, e^{j\pi/2},\right) = (1,1,1,-j,1,j,1,j,)$$

The four data bits (d_0 to d_3) thus become the eight complex output chips (c_0 to c_7).

11 Mbps Data Rate with CCK Modulation

The standard also specifies CCK modulation (complementary code keying) for a data rate of 11 Mbps. The modulation is basically the same as described for the 5.5 Mbps data rate. In each modulation step, eight successive bits (d_0 to d_7) are taken from the data stream, which is already scrambled. The phases $\varphi_1, \varphi_2, \varphi_3, \varphi_4$ are determined by these eight bits.

φ_1 is determined by the data bits d_0 and d_1 according to the following table, which specifies different phases for even and odd modulation steps:

Dibit pattern (d0, d1) (d0 is first in time)	Even symbols phase change (+jω)	Odd symbols phase change (+jω)
00	0	π
01	$\pi/2$	$3\pi/2$ ($-\pi/2$)
11	π	0
10	$3\pi/2$ ($-\pi/2$)	$\pi/2$

The phase φ_1 must be interpreted relative to the phase of the previous symbol.

φ_2 is determined by the data bits d_2, d_3, φ_3 from d_4, d_5 and φ_2 from d_6, d_7 according to the following table:

Dibit pattern [di, d(i+1)] (di is first in time)	Phase
00	0
01	$\pi/2$
10	π
11	$3\pi/2$ ($-\pi/2$)

5.5 Mbps and 11 Mbps Data Rates with PBCC Modulation

Packet binary convolutional coding (PBCC) can optionally be used instead of CCK modulation for the 5.5 Mbps and 11 Mbps data rates. The following illustration provides a schematic overview of this method. For details, refer to the standard.

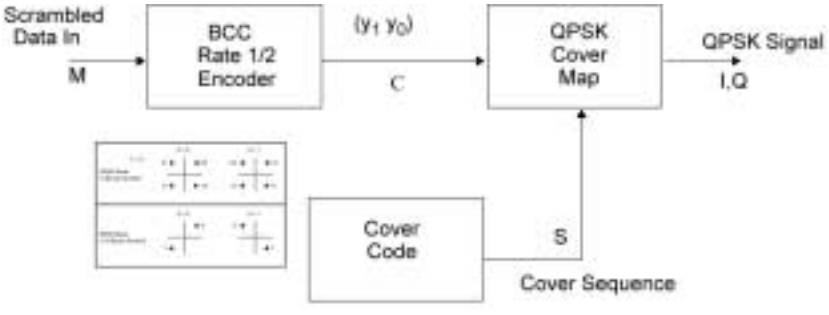


Fig. 4-2 Principle of PBCC modulation

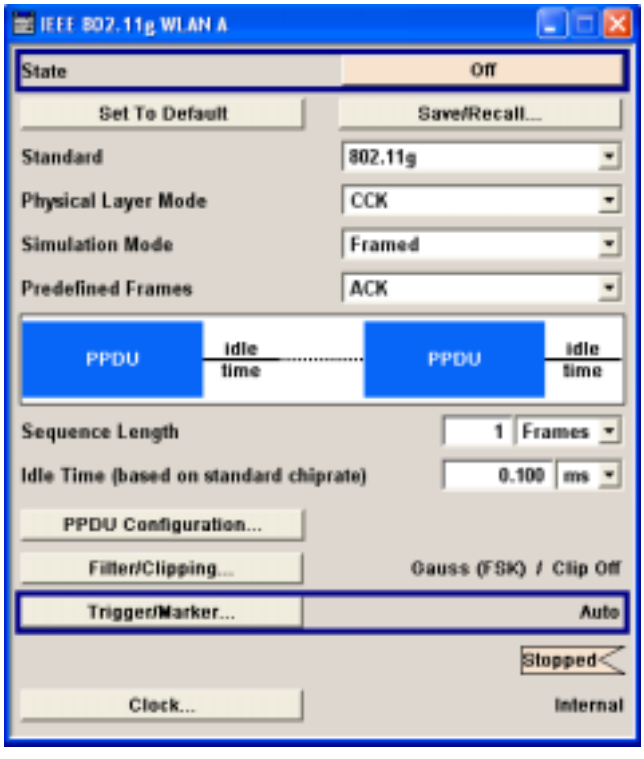
22 Mbps and 33 Mbps Data Rates with PBCC Modulation

802.11g also defines the optional PBCC (ER-PBCC) modes using the extended 22 Mbps and 33 Mbps rates (see [3], 19.3.3.2). In contrast to the 5.5 Mbps and 11 Mbps PBCC modes, a rate 2/3 convolutional coder and 8PSK modulation are used. With 33 Mbps, also the clock rate in the data section of the packet is increased to 16.5 Mcps.

WLAN Menu

The menu for setting the IEEE 802.11a-g WLAN digital standard is either called from the baseband block or from the menu tree under Baseband.

The menu is split into several sections for configuring the standard. The choice of simulation mode determines which displays and parameters are made available in the lower section.



The upper section of the menu is where the IEEE 802.11a-g WLAN digital standard is enabled, the default settings are called and the physical layer mode, the simulation mode and the frame type are selected. Additional parameters for defining the signal length and a graph outlining the signal structure are indicated.

A button leads to the submenu for loading and saving the IEEE 802.11a-g WLAN configuration.

The buttons of the lower menu section lead to submenus for configuring the PPDU and for setting the filter, clipping, trigger and clock parameters.

The upper menu section is where the IEEE 802.11a-g WLAN digital standard is enabled and the basic signal structure is configured.

State

Enables/disables the IEEE 802.11a-g WLAN standard.
Enabling this standard disables all the other digital standards and digital modulation modes on the same path.

Remote-control command:
`SOUR:BB:WLAN:STAT ON`

Set to default

Calls the default settings. The following table gives an overview of the settings. The preset value for each parameter is specified in the description of the remote-control commands.

Remote-control command:
`SOUR:BB:WLAN:PRES`

Parameter	Value
General Settings	
State	Not affected by Set to default
Standard	802.11g
Physical Layer Mode	CCK
Simulation Mode	Framed
Predefined Frames	Data
Sequence Length	1 frame
Idle Time	0.1 ms
Filter	Gauss (FSK), 0.50
Chip Rate Variation	11 Mcps
Clipping	Off
PPDU Configuration (CCK)	
PLCP P+H Format	Long PLPC
PSDU Bit Rate (CCK/PBCC)	11 Mbps
Data Length	1024 bytes
PSDU Data Source	PRBS 9
Scrambling	On
Service Field Clock Bits	Locked
MAC Header	Off
FCS (checksum)	Off

Save/Recall...

Calls the **Save/Recall** menu.
From the **Save/Recall** menu the **File Select** windows for saving and recalling IEEE 802.11a-g WLAN configurations and the **File Manager** can be called.

IEEE 802.11a-g WLAN configurations are stored as files with the predefined file extension ***.wlan.** The file name and the directory they are stored in are user-definable.
The complete settings in the **IEEE 802.11a-g WLAN** menu are saved and recalled.

Recall IEEE 802.11a-g WLAN setting

Opens the **File Select** window for loading a saved IEEE 802.11a-g WLAN configuration.

The configuration of the selected (highlighted) file is loaded by pressing the **Select** button.

Remote-control command:
```
MMEM:CDIR 'F:\gen_lists\wlan'

SOUR:BB:WLAN:SETT:CAT?
                    Response:
'wlan_1',wlan_2'
SOUR:BB:WLAN:SETT:LOAD "wlan_1"
```

Save IEEE 802.11a-g WLAN setting

Opens the **File Select** window for saving the current IEEE 802.11a-g WLAN signal configuration.

The name of the file is specified in the **File name** entry field, the directory selected in the **save into** field. The file is saved by pressing the **Save** button.

Remote-control command:
```
MMEM:CDIR 'F:\gen_lists\wlan'

SOUR:BB:WLAN:SETT:STOR 'wlan_3'
```

File Manager

Calls the **File Manager**.
The **File Manager** is used to copy, delete and rename files and to create new directories.

Remote-control commands::
```
MMEM:CDIR 'F:\gen_lists\wlan'

SOUR:BB:WLAN:SETT:DEL 'wlan_1'
```

Standard

Selects the 802.11 standard.
The standard was expanded over the years adding additional features.

802.11a

The standard supports OFDM (orthogonal frequency division multiplexing). This modulation is defined by the IEEE 802.11a specification in the 5 GHz frequency band.

Remote-control command:
```
SOUR:BB:WLAN:STAN STAN80211A
```

802.11b

The standard includes the modulation mode CCK (complementary code keying) and the data rates 5.5 Mbps and 11 Mbps. PBCC (packet binary convolutional coding) can optionally be used instead of CCK modulation for the 5.5 Mbps and 11 Mbps data rates.

Remote-control command:
```
SOUR:BB:WLAN:STAN STAN80211B
```

802.11g Standard 802.11g extends standard 802.11b with higher transmission rates. 802.11g contains the previous 802.11b modes and also integrates the OFDM method used in 802.11a for frequencies in the 2.4 GHz band.

Remote-control command:
`SOUR:BB:WLAN:STAN STAN80211G`

Physical Layer Mode Selects the physical layer mode.

OFDM The OFDM (orthogonal frequency division multiplexing) physical layer supports a frame-based transmission. The OFDM signal is divided into 52 carriers. The symbol rate of the modulation on the individual carriers is 250 kHz. A user data rate of up to 54 Mbps at a channel bandwidth of 20 MHz can be obtained by combining 48 useful carriers for data transmission (4 carriers are used for pilots) and using 64QAM for subcarrier modulation. With OFDM, the individual carriers are superimposed mutually orthogonal, which, in the ideal case, does not cause any intercarrier interference (ICI).

Remote-control command:
`SOUR:BB:WLAN:MODE OFDM`

CCK The CCK (complementary code keying) physical layer mode is used for the 5.5 Mbps and 11 Mbps data rates.

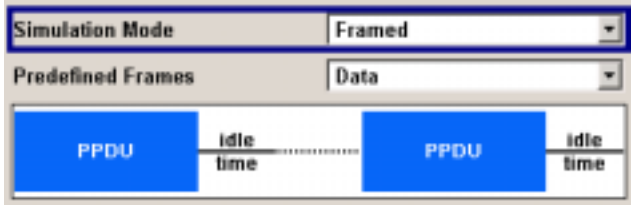
Remote-control command:
`SOUR:BB:WLAN:MODE CCK`

PBCC The PBCC (packet binary convolutional coding) physical layer can optionally be used instead of CCK modulation and extents 802.11b to higher data rates (22 Mbps).

Remote-control command:
`SOUR:BB:WLAN:MODE PBCC`

Simulation Mode Selects the simulation mode.

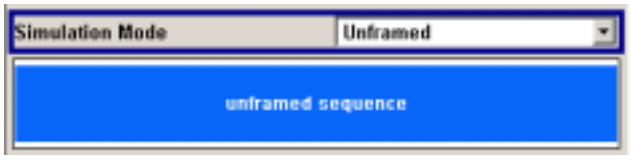
Framed The **framed mode** is the standard operating mode which is also used in the real system. Data packets with the frame structure defined by the standard are generated.



Signals representing a sequence of frames (PLCP protocol data units, referred to as PPDUs) and separated by a so-called idle time can be configured in the framed mode. The user data is continued in the consecutive frames, i.e. it is not repeated in each frame. Both the duration of the idle time and the number of frames to be sent can be user-selected.

Remote-control command:
`SOUR:BB:WLAN:SMOD FRAM`

Unframed The **unframed mode** is offered in addition. In this mode, a non-packet-oriented signal without a frame structure is generated with the modulations and data rates defined by 802.11a-g. This mode can be used for simple tests for which only modulation and spectrum of the test signal are of interest.



No PLCP preamble and no signal field are generated in the unframed mode. The idle time is also omitted. The data field is identical to that of the framed mode and also contains the service and tail bits. The length limitation stipulated by the standard to the maximum PSDU block length of 4095 bytes in the framed mode does not apply.

Operation is the same as in the framed mode, but only a limited number of setting parameters is available.

Remote-control command:
`SOUR:BB:WLAN:MODE UNFRM`

Predefined Frames (Framed Mode only)

Selects the frame type. The selection defines parameters of the MAC layer, e.g. the type and sub-type bit fields of the MAC Header.

Data Frames containing useful data.

Remote-control command:
`SOUR:BB:WLAN:FFOR DATA`

RTS Request to Send.

Remote-control command:
`SOUR:BB:WLAN:FFOR RTS`

CTS Clear to Send.

Remote-control command:
`SOUR:BB:WLAN:FFOR CTS`

ACK Acknowledgement.

Remote-control command:
`SOUR:BB:WLAN:FFOR ACK`

User Indicates that no predefined frame type is selected, i.e. on deactivated MAC Header.

Remote-control command:
`SOUR:BB:WLAN:FFOR USER`

Sequence Length (Framed Mode only)

Sets the sequence length of the signal in number of frames. A (physical layer) frame consists of a PPDU burst including the subsequent idle time.

Remote-control command:
`SOUR:BB:WLAN:SLEN 20`

Idle Time (based on standard chip rate) (Framed Mode only)

Sets the idle time, i.e. the time between two PPDU bursts. Idle time is given in µs; the packets can also be joined to each other directly with idle time 0. Please note that the idle time refers to the chip rate as defined in the standard (11 Mcps for 802.11b/g CCK/PBCC and 20 Mcps for 802.11a/g OFDM). Only at this chip rate does the idle period correspond exactly to the time set. If the chip rate is doubled, for instance, the real idle time is halved.

Remote-control command:
`SOUR:BB:WLAN:ITIM 10 ms`

PPDU Configuration... (Framed Mode only)

Calls the menu for configuration of the PPDU. The menu differs for the physical layer modes.
The menu is described in Section "*PPDU/Sequence Configuration - WLAN*", Page 106.

Remote-control command: n.a.

Sequence Configuration... (Unframed Mode only)

Calls the menu for configuration of the signal in unframed mode modes.
The menu is described in Section "*PPDU/Sequence Configuration - WLAN*", Page 106.

Remote-control command: n.a.

Filter, Clipping...

Calls the menu for setting the filter parameters and the clipping. The current setting is displayed next to the button.
The menu is described in Section "*Filter, Clipping - WLAN*", Page 117.

Remote-control command: n.a.

Trigger / Marker...

Calls the menu for selecting the trigger source, for configuring the marker signals and for setting the time delay of an external trigger signal (see Section "*Trigger/Marker/Clock - WLAN*", Page 119).
The currently selected trigger source is displayed to the right of the button.

Remote-control command: n.a.

Execute Trigger (only Trigger Source Internal)

Executes trigger manually.
A manual trigger can be executed only when an internal trigger source and a trigger mode other than **Auto** have been selected.

Remote-control commands:
```
SOUR:BB:WLAN:TRIG:SOUR INT
SOUR:BB:WLAN:SEQ RETR
SOUR:BB:WLAN:TRIG:EXEC
```

Clock...

Calls the menu for selecting the clock source (see Section "*Trigger/Marker/Clock - WLAN*", Page 119).

Remote-control command: n.a.

PPDU/Sequence Configuration - WLAN

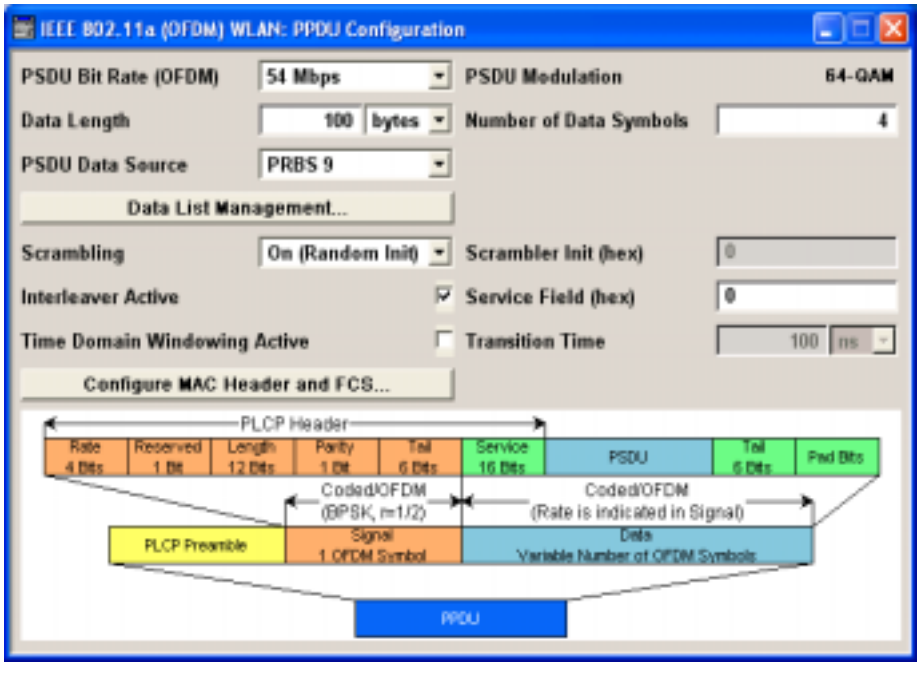
In **framed mode**, a frame consists of a PPDU (PLCP protocol data unit) and the idle time. The data packet on the physical layer is referred to as PPDU. A PPDU consists of three components; the PLCP preamble, the PLCP header and the PSDU (PLCP service data unit), which contains the actual information data (coming from higher layers).
The PLCP preamble and header are used for synchronization and signaling purposes, and are themselves divided into fields.

The details of the PPDU structure depend on the selected standard or, more precisely, on the physical layer mode (see below).

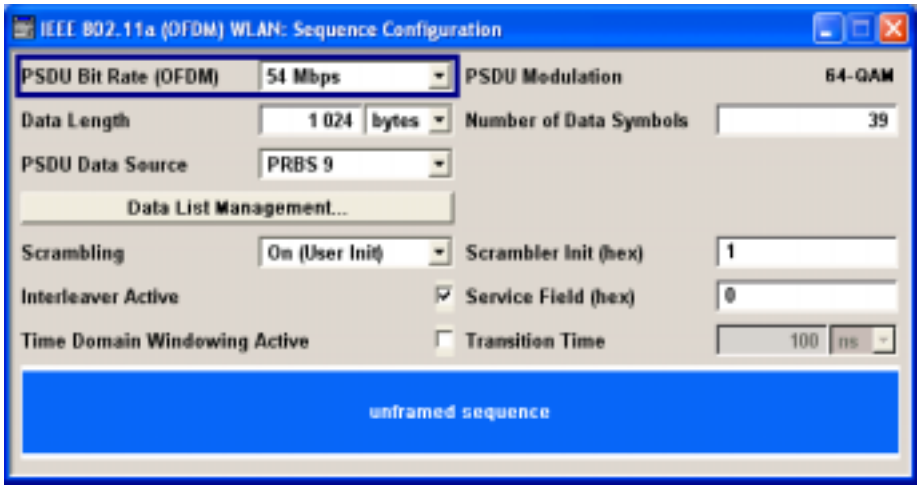
In **unframed mode**, the signal can be configured via the **PSDU bit rate** and **PSDU modulation** parameters, just as in the Framed mode. However, a preamble or header is not generated; only a continuous PSDU block is generated, the length of which can be varied by using the **Sequence Length** parameter. There is no restriction of the maximum PSDU block length to 4095 bytes as in the Framed mode. Moreover, the data stream can be scrambled prior to the modulation (**Scrambling Mode** parameter).

Standard 802.11a - OFDM
In the upper section of the menu, the parameters of the data part (PSDU) are set. In the middle section, the parameters of the scrambler and interleaver are set. A graph in the lower sections illustrates the structure of the PPDU (framed mode) or the unframed sequence (unframed mode).

Framed mode:



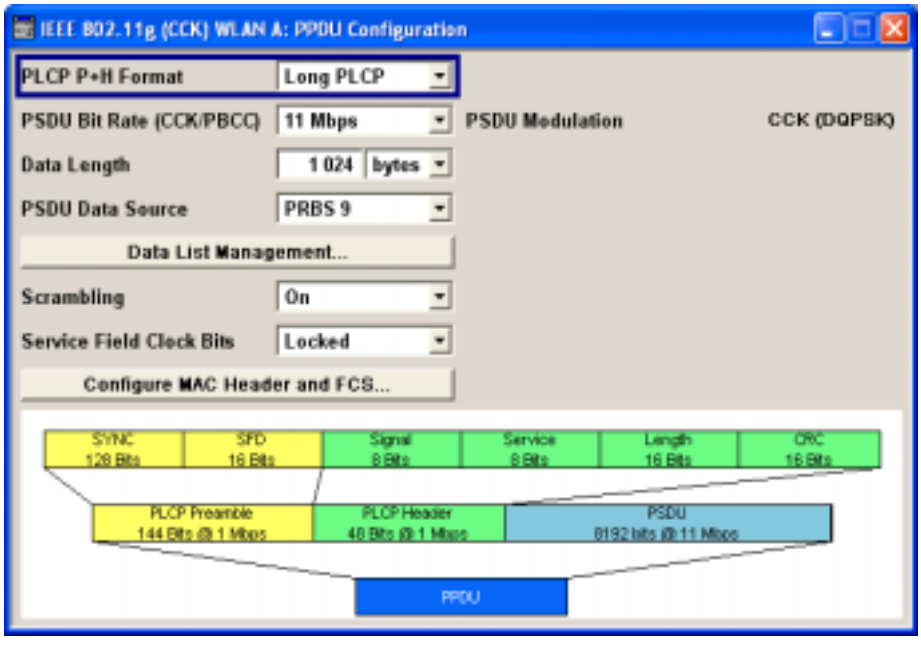
Unframed mode:



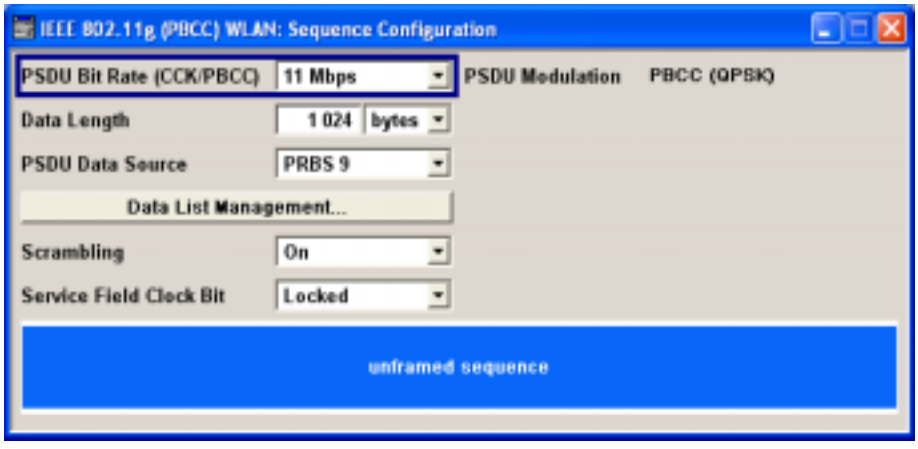
Standard 802.11b/g - CCK - PBCC

In the upper section of the menu, the parameters of the data part (PSDU) are set. In framed mode, a distinction is made between the packet type (or PPDU format) with long or short PLCP (physical layer convergence protocol). A graph in the lower sections illustrates the structure of the PPDU (framed mode) or the unframed sequence (unframed mode).

Framed Mode:



Unframed Mode:



PLCP P+H Format (CCK,PBCC) (framed mode)

Selects the packet type (PPDU format) with long or short PLCP (physical layer convergence protocol). Depending on the format selected, the structure, modulation and data rate of the PLCP preamble and header are modified. The format currently set is shown in the graphic display in the lower part of the menu.
See section "*Physical Layer CCK-PBCC*", on page 95, for description of the long and short format

Remote-control command:
`SOUR:BB:WLAN:PLCP:FORM LONG`

PSDU Bit Rate (OFDM)

Selects the bit rate of the PSDU.
All data rates defined by the standard are supported. The selection of the PSDU bit rate automatically determines the code rate of the convolutional coder and the subcarrier modulation of the OFDM.

Remote-control command:
`SOUR:BB:WLAN:PSDU:BRAT 11MBPS`

PSDU Bit Rate (CCK,PBCC)

Selects the bit rate of the PSDU.
The data rates available are 1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps and 22 Mbps. The 1 Mbps data rate is only available if the long PLCP format has been selected (framed mode only). The selection of the data rate also determines the possible modulation modes. The following table shows the correlation between data rate and modulation:

Remote-control command:
`SOUR:BB:WLAN:PSDU:BRAT 18MBPS`

Data rate	Possible modulation mode
1 Mbps	Barker Sequence (DBPSK) the information data sequence is spread with an 11-chip Barker sequence, chip rate is 11 Mcps
2 Mbps	Barker Sequence (DQPSK) the information data sequence is spread with an 11-chip Barker sequence, chip rate is 11 Mcps
5.5 Mbps	CCK (DQPSK) or PBCC (BPSK)
11 Mbps	CCK (DQPSK) or PBCC (QPSK)
22 Mbps	PBCC (8PSK)

PSDU Modulation (OFDM)

Indicates the modulation type used on the OFDM subcarriers. The modulation mode depends on the selected PSDU bit rate.

Remote-control command:
`SOUR:BB:WLAN:PSDU:MOD QAM16`

PSDU Modulation (CCK,PBCC)

Indicates the modulation type. The modulation mode depends on the selected PSDU bit rate. The **Physical Layer Mode** parameter in the main menu can be used for switchover between CCK and PBCC.

Remote-control command:
`SOUR:BB:WLAN:PSDU:MOD CCK`

Data Length

Sets the data length.
In the framed mode, data field lengths of up to 4095 bytes per frame packet are possible. This corresponds to the maximum data length. If the MAC Layer is activated, the MAC header (up to 30) and the (4) FCS bytes are added.
The unframed mode offers a data length of up to 100000 bytes.

OFDM:
If the data field length is changed, the generator calculates the number of OFDM data symbols as a function of the set PSDU bit rate and displays it in the field **Number of Data Symbols**. Data is always rounded up to complete symbols. Free data bits in the last symbol, the so-called pad bits, are filled with 0.

Remote-control command:
`SOUR:BB:WLAN:PSDU:DLEN 4095`

Number of Data Symbols (OFDM)

Sets the number of data symbols for the data field.
If the number of OFDM data symbols is changed, the generator calculates the data field length as a function of the set bit rate and displays it at **Data Length**.

Remote-control command:
`SOUR:BB:WLAN:PSDU:SCO 256`

PSDU Data Source

Selects the data source for the data field.
The following data sources are available:

All 0
All 1

0 data or 1 data is internally generated.

Remote-control command:
`SOUR:BB:WLAN:PSDU:DATA ONE | ZERO`

PRBS
PRBS Type

PRBS data in accordance with the IUT-T with period lengths between 2^9-1 and 2^{23}-1 are internally generated.

The length is selected in the **PRBS Type** input box.

Remote-control commands
`SOUR:BB:WLAN:PSDU:DATA PN9`

Pattern

Pattern A user-definable bit pattern with a maximum length of 64 bits is internally generated.

The bit pattern is defined in the **Pattern** input box.

Remote-control command::
`SOUR:BB:WLAN:PSDU:DATA PATT`
`SOUR:BB:WLAN:PSDU:DATA:PATT #H77550,17`

Data List Data lists will be used.

...Select Data Data lists can be generated internally in the data editor or externally.

Data lists are selected in the **File Select** window, which is called by means of the **Data List Management** button.

The **File Manager** is used to transmit external data lists to the R&S Vector Signal Generator, and can be called within every File Select window by means of the **File Manager** button.

Remote-control command:
`SOUR:BB:WLAN:PSDU:DATA DLIS`
`SOUR:BB:WLAN:PSDU:DATA:DLIS:SEL "d_l1"`

Scrambling (OFDM)

Activates/deactivates the scrambler and selects the mode of determining the initialization value..

OFF The scrambler is deactivated.

Remote-control command:
`SOUR:BB:WLAN:SCR:MODE OFF`

Random The scrambler is activated.
The initialization value of the scrambler is selected at random. Each frame has a different random initialization value. This value is also different in case of successive recalculations with the same setting parameters so that different signals are generated for each calculation.

Remote-control command:
`SOUR:BB:WLAN:SCR:MODE RAND`

User The scrambler is activated.

The initialization value of the scrambler is set to a fixed value that is entered at **Scrambler Init (hex)** . This value is then identical in each generated frame.

Remote-control command:
`SOUR:BB:WLAN:SCR:MODE USER`

Scrambling (CCK,PBCC)

Activates or deactivates the scrambler. Some tests require a test signal without scrambling (e.g. for the RF carrier suppression measurement)..

OFF The scrambler is deactivated.

Remote-control command:
`SOUR:BB:WLAN:SCR:MODE OFF`

ON The scrambler is activated.

Remote-control command:
`SOUR:BB:WLAN:SCR:MODE ON`

Preamble Only The scrambler is activated.
Only the preamble is scrambled.

Remote-control command:
`SOUR:BB:WLAN:SCR:MODE PRE`

Service Field Clock Bit (CCK,PBCC)

Sets the Locked Clock Bit in Service Field of the PLCP Header.
Via this flag (bit), the 802.11b/g transmitter indicates whether transmission frequency and symbol rate have been derived from the same oscillator. If this is the case (locked), the bit is set to 1, otherwise (not locked) to 0.

Remote-control command:
`SOUR:BB:WLAN:PLCP:LCB:STAT ON`

Barker Spreading (CCK,PBCC)

Activates/deactivates barker spreading (bit rates 1 Mbps or 2 Mbps only).

Remote-control command:
`SOUR:BB:WLAN:PSDU:BSPR:STAT ON`

Scrambler Init (hex) (OFDM)

Enters the initialization value for scrambling mode User. This value is then identical in each generated frame.

Remote-control command:
`SOUR:BB:WLAN:SCR:PATT #H3F,8`

Interleaver Active (OFDM)

Activates/deactivates the interleaver.

Remote-control command:
`SOUR:BB:WLAN:ILE:STAT ON`

Service field (hex)

Enters the value of the service field. The standard specifies a default value of 0. Other values can be entered in hexadecimal form for test purposes or future extensions.

Remote-control command:
`SOUR:BB:WLAN:SERV:PATT #H3F,8`

Time Domain Windowing Active

Activates/deactivates the time domain windowing. Time domain windowing is a method to influence the spectral characteristics of the signal, which is not stipulated by the standard. However, it does not replace oversampling and subsequent signal filtering.

Remote-control command:
`SOUR:BB:WLAN:TDW:STAT OFF`

Transition Time (OFDM only)

Sets the transition time when time domain windowing is active.
The transition time defines the overlap range of two OFDM symbols. At a setting of 100 ns, one sample overlaps.

Remote-control command:
`SOUR:BB:WLAN:TTIM 0.0005ms`

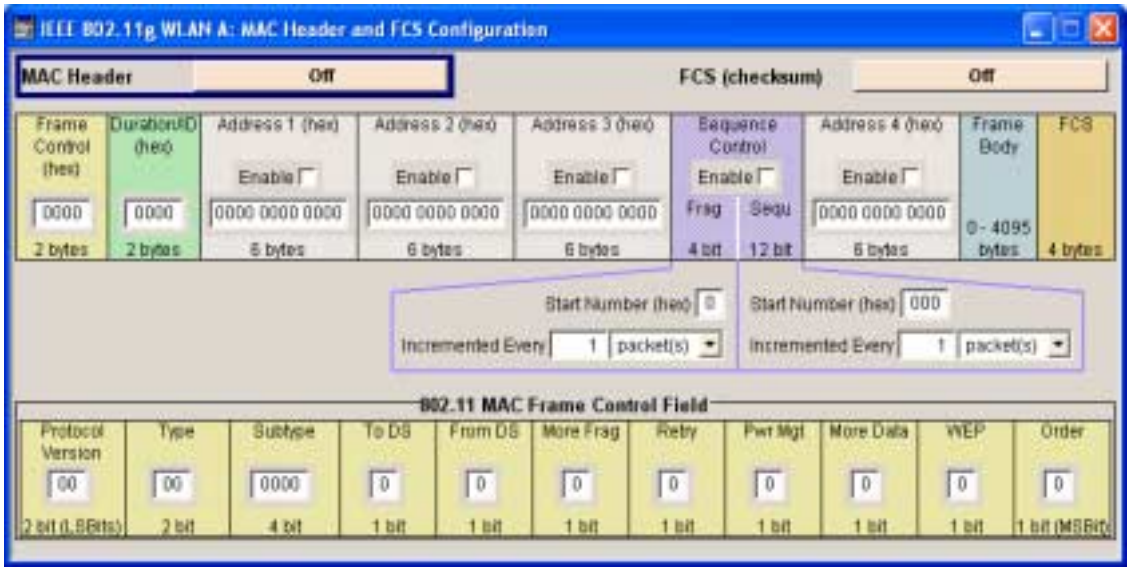
Configure MAC Header and FCS...

Calls the menu for configuration of the MAC Header and FSC.
The menu is described in the following Section.

Remote-control command: -

MAC Header and FCS Configuration - WLAN

In the real IEEE 802.11 system, a MAC (medium access control) header is transmitted in the PSDU prior to the actual data section. This header comprises control information of the MAC layer. It is also possible to protect the PSDU by a frame checksum. These two functions can be controlled in the menu.



FCS (checksum)

Activates/deactivates the calculation of the FCS (frame check sequence). The standard defines a 32-bit (4-byte) check sum to protect the MAC header and the user data (frame body).

Remote-control command:
`SOUR:BB:WLAN:PSDU:MAC:FCS:STAT ON`

MAC Header

Activates/deactivates the generation of the MAC Header for the PSDU. If the MAC header is activated, all MAC header fields are enabled for operation.
The individual fields of the MAC header are described in the following. All values of the MAC fields (except addresses) are entered in hexadecimal form with LSB in right notation. In the data stream, the values are output standard-conformal with the LSB coming first.

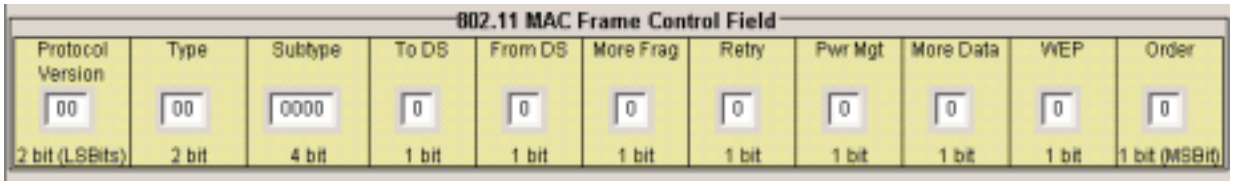
Remote-control command:
`SOUR:BB:WLAN:PSDU:MAC:STAT ON`

Frame Control

Enters the value of the frame control field.
The Frame control field has a length of 2 bytes (16 bits) and is used to define the protocol version, the frame type, sub type and its function, etc.. As an alternative, the individual bits can be set in the lower part of the graph.

Remote-control command:
```
SOUR:BB:WLAN:PSDU:MAC:FCON #H100A,16
SOUR:BB:WLAN:PSDU:MAC:FCON:PVER #H8,2
SOUR:BB:WLAN:PSDU:MAC:FCON:TYPE  #H8,2
SOUR:BB:WLAN:PSDU:MAC:FCON:SUBT  #H5,4
SOUR:BB:WLAN:PSDU:MAC:FCON:TDS  #H8,1
SOUR:BB:WLAN:PSDU:MAC:FCON:FDS  #H0,1
```

```
SOUR:BB:WLAN:PSDU:MAC:FCON:MFR  #H8,1
SOUR:BB:WLAN:PSDU:MAC:FCON:RETR  #H0,1
SOUR:BB:WLAN:PSDU:MAC:FCON:PMAN  #H0,1
SOUR:BB:WLAN:PSDU:MAC:FCON:MDAT  #H8,1
SOUR:BB:WLAN:PSDU:MAC:FCON:WEP  #H0,1
SOUR:BB:WLAN:PSDU:MAC:FCON:ORD  #H8,1
```



Duration Id

Enters the value of the duration Id field.
Depending on the frame type, the 2-byte field Duration/ID is used to transmit the association identity of the station transmitting the frame or it indicates the duration assigned to the frame type.

Remote-control command:
```
SOUR:BB:WLAN:PSDU:MAC:DID #HA5A5,16
```

Address 1 ... 4

Enters the value of the address fields 1 ... 4.
The MAC header may contain up to four address fields, but not all of them must be available. Each of the 4 address fields can be activated or deactivated. The fields are used for transmitting the basic service set identifier, the destination address, the source address, the receiver address and the transmitter address. Each address is 6 bytes (48 bit) long. The addresses can be entered in hexadecimal form in the entry field of each address field. The least significant byte (LSB) is in left notation.

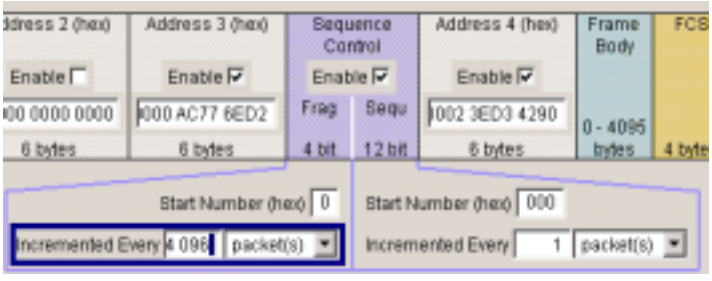
Remote-control command:
```
SOUR:BB:WLAN:PSDU:MAC:ADDR2:STAT ON
SOUR:BB:WLAN:PSDU:MAC:ADDR2 #H124836C7EA54,48
```

Sequence Control

Activates/deactivates the sequence control field.
The sequence control field has a length of 2 bytes and is divided in two parts, the fragment number (4 bits) and the sequence number (12 bits) field. A long user data stream to be transmitted is first split up into MSDUs (MAC service data units) which can either be transmitted as PSDU frames or further divided into fragments. The sequence number and the fragment number are then used to number the individual subpackets of the user data stream to be transmitted. Thus, all PSDUs are assigned a consecutive number. This allows the receiver to arrange the data packets in the correct order, to determine whether an incorrectly transmitted packet was retransmitted and to find out whether packets are missing.
If the receiver can detect a packet without an error and does not request a retransmission, the sequence number is incremented by 1 for each packet (the field is reset to 0 at the latest after a count of 4095). The fragment number field is incremented by 1 when another fragment of the current MPDU is transmitted.

The start count for the transmission (normally 0) and the number of packets required to increment the corresponding counter can be defined for both numbers. This is done with the parameters **Start Number** and **Incremented every ... packet(s)** (see below).

Example:
An error-free transmission of 50 packets (no packet retransmission) is to be simulated. The sequence number should be incremented by 1 for each packet. Since no packet is fragmented, the fragment counter can always remain at 0. In this case the following values have to be set:



If it is to be simulated that some packets are received incorrectly or if the response of the receiver should be tested when the same packet arrives several times, the number of packets required to increment the sequence number can be set to 2, for example. Each packet will then automatically be sent twice (with identical data).

Remote-control command:
`SOUR:BB:WLAN:PSDU:MAC:SCON:STAT ON`

Start Number

Sets the start number of the fragment bits or the sequence bits of the sequence control (see example above).

Remote-control command:
`SOUR:BB:WLAN:PSDU:MAC:SCON:FRAG:STAR #H0,4`
`SOUR:BB:WLAN:PSDU:MAC:SCON:SEQ:STAR #H0,4`

Increment Every

Defines the number of packets required to increment the counter of the fragment bits or the sequence bits of the sequence control (see example above).

Remote-control command:
`SOUR:BB:WLAN:PSDU:MAC:SCON:FRAG:INCR 2`
`SOUR:BB:WLAN:PSDU:MAC:SCON:SEQ:INCR 1024`

Frame Body

Indicates the length of the user data (frame body).

Remote-control command: -

FCS

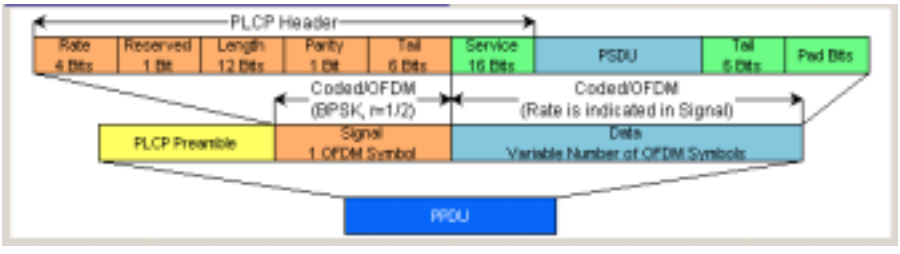
Indicates the length of the check sum.

Remote-control command: -

PPDU Graph - WLAN

The frame graph in the lower part of the menu indicates the configuration of the PPDU.
The frame structure for the different physical layer modes is described in section "*Physical Layer CCK-PBCC*", on page 95.

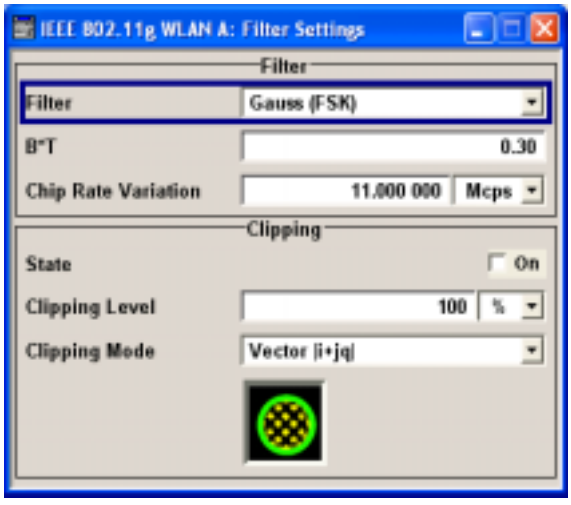
Physical Layer Mode OFDM



Physical Layer Mode CCK, Long PLCP

Filter, Clipping - WLAN

The **Filter, Clipping...** menu is reached via the WLAN main menu.
The filter type and parameters, the chip rate variation (**Filter** section) and clipping (**Clipping** section) are defined in this menu..



In the **Filter** section, the settings are made for the baseband filter.

Filter

Selects baseband filter. A selection window contains all the filters available to the instrument.
In 802.11a/g OFDM mode, a cosine filter with roll-off factor 0.1 is used by default to achieve the spectrum masks requirement.
In 802.11b/g CCK/PBCC mode, a gauss (FSK) filter with B*T 0.5 is used by default to achieve the spectrum masks requirement.

Remote-control command:
`SOUR:BB:WLAN:FILT:TYPE RCOS`

Roll Off Factor
or
BxT

Enters the filter parameters.
The filter parameter offered (Roll Off factor or B*T) depends on the currently selected filter type. This parameter is always set to the default for each of the predefined filters.

Remote-control commands:
`SOUR:BB:WLAN:FILT:PAR:APCO25 0.2`
`SOUR:BB:WLAN:FILT:PAR:COS 0.35`
`SOUR:BB:WLAN:FILT:PAR:GAUS 0.5`
`SOUR:BB:WLAN:FILT:PAR:PGA 0.5`
`SOUR:BB:WLAN:FILT:PAR:RCOS 0.35`
`SOUR:BB:WLAN:FILT:PAR:SPH 2`

Chip Rate Variation

Enters the chip rate. For each physical layer mode an own parameter is defined. Which parameter is affected depends on the currently selected mode.
The chip rate entry changes the output clock and the modulation bandwidth, as well as the synchronization signals that are output. It does not affect the calculated chip sequence.

Remote-control command:
`SOUR:BB:WLAN:CRAT:VAR 11MCPS`

The settings for clipping are collected in the **Clipping** section.

State

Switches baseband clipping on and off.

Baseband clipping is a very simple and effective way of reducing the crest factor of the WLAN signal.
WLAN signals may have high crest factors particularly in the 802.11a/g OFDM mode. High crest factors entail two basic problems:

- The nonlinearity of the power amplifier (compression) causes intermodulation which expands the spectrum (spectral regrowth).
- Since the level in the D/A converter is relative to the maximum value, the average value is converted with a relatively low resolution. This results in a high quantization noise.

Both effects increase the adjacent-channel power.

With baseband clipping, all the levels are limited to a settable value (**Clipping Level**). This level is specified as a percentage of the highest peak value. Since clipping is done prior to filtering, the procedure does not influence the spectrum. The EVM however increases. Since clipping the signal not only changes the peak value but also the average value, the effect on the crest factor is unpredictable.

Remote-control command:
`SOUR:BB:WLAN:CLIP:STAT ON`

Clipping Level

Sets the limit for clipping.
This value indicates at what point the signal is clipped. It is specified as a percentage, relative to the highest level. 100% indicates that clipping does not take place.

Remote-control command:
`SOUR:BB:WLAN:CLIP:LEV 50`

Clipping Mode

Selects the clipping method. A graphic illustration of the way in which these two methods work is given in the menu.

Vector | i + q |

The limit is related to the amplitude | I + jQ | . The I and Q components are mapped together, the angle is retained.

Remote-control command:
`SOUR:BB:WLAN:CLIP:MODE VECT`

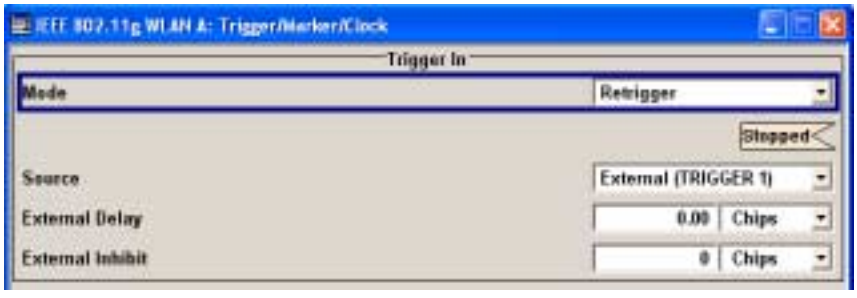
Scalar | i | + | q |

The limit is related to the absolute maximum of all the | I | and | Q | values. The I and Q components are mapped separately, the angle changes.

Remote-control command:
`SOUR:BB:WLAN:CLIP:MODE SCAL`

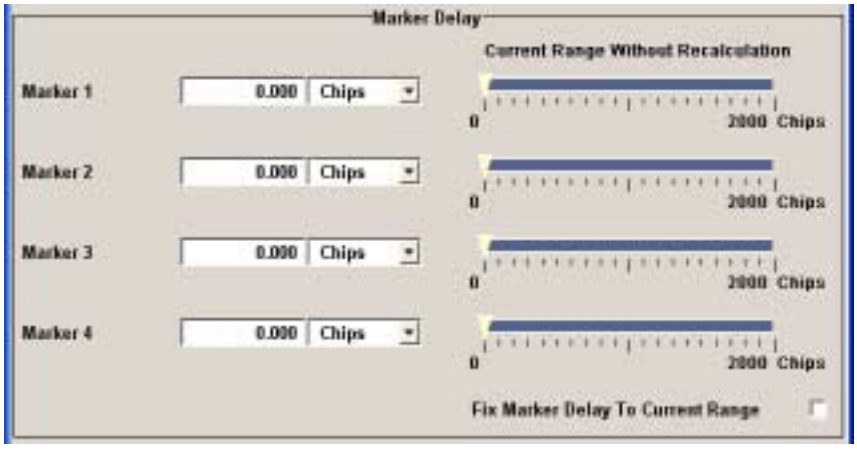
Trigger/Marker/Clock - WLAN

The **Trigger/Marker/Clock** menu can be reached via the IEEE 802.11a-g WLAN main menu.

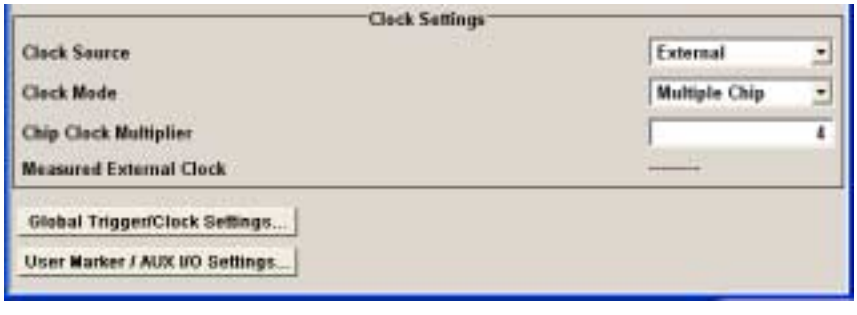


The **Trigger In** section is where the trigger for the IEEE 802.11a-g WLAN signal is set. Various parameters will be provided for the settings, depending on which trigger source - internal or external - is selected. The current status of signal generation (**Running** or **Stopped**) is indicated for all trigger modes.

The **Marker Mode** section is where the marker signals at the MARKER output connectors are configured.



The **Marker Delay** section is where a marker signal delay can be defined, either without restriction or restricted to the dynamic section, i.e., the section in which it is possible to make settings without restarting signal and marker generation.



The **Clock Settings** section is where the clock source is selected and - in the case of an external source - the clock type.

The **Global Trigger/Clock Settings** button leads to a submenu for general trigger and clock settings.
The **User marker / AUX I/O Settings** button leads to a submenu for mapping the AUX I/O connector on the rear of the instrument

The **Trigger In** section is where the trigger for the IEEE 802.11a-g WLAN signal is set. The current status of the signal generation is displayed for all trigger modes.

Trigger Mode

Selects trigger mode.
The trigger mode determines the effect of a trigger on the signal generation.

Auto

The IEEE 802.11a-g WLAN signal is generated continuously.

Remote-control command::
`SOUR:BB:WLAN:SEQ AUTO`

Retrigger

The IEEE 802.11a-g WLAN signal is generated continuously. A trigger event (internal or external) causes a restart.

Remote-control command:
`SOUR:BB:WLAN:SEQ RETR`

Armed_Auto

The IEEE 802.11a-g WLAN-Signal signal is generated only when a trigger event occurs. Then the signal is generated continuously.

Button **Arm** stops signal generation. A subsequent trigger event (internal with **Execute Trigger** or external) causes a restart.

Remote-control command:
`SOUR:BB:WLAN:SEQ AAUT`

Armed_Retrig

The IEEE 802.11a-g WLAN-Signal signal is generated only when a trigger event occurs. Then the signal is generated continuously. Every subsequent trigger event causes a restart.

Button **Arm** stops signal generation. A subsequent trigger event (internal with **Execute Trigger** or external) causes a restart.

Remote-control command:
`SOUR:BB:WLAN:SEQ ARET`

Single

The IEEE 802.11a-g WLAN signal is generated only when a trigger event occurs. Then the signal is generated once to the length specified at **Signal Duration**. Every subsequent trigger event (internal with **Execute Trigger** or external) causes a restart.

Remote-control command:
`SOUR:BB:WLAN:SEQ SING`

Signal Duration Unit

Defines the unit for the entry of the length of the signal sequence to be output in the **Single** trigger mode. Available units are frame, chip or sequence length (SL).

Remote-control commands:
`SOUR:BB:WLAN:TRIG:SLUN FRAM`

Signal Duration

Defines the length of the signal sequence to be output in the **Single** trigger mode. The input is to be expressed in chips. It is then possible to output deliberately just part of the signal, an exact sequence of the signal, or a defined number of repetitions of the signal.

Remote-control commands:
`SOUR:BB:WLAN:TRIG:SLEN 2000`

Running / Stopped

Displays the status of signal generation for all trigger modes. This display appears only when IEEE 802.11a-g WLAN is enabled (**State On**).

Remote-control command:
`SOUR:BB:WLAN:TRIG:RMOD?` Response: RUN or STOP

Running The IEEE 802.11a-g WLAN modulation signal is generated; a trigger was (internally or externally) initiated in triggered mode.

If Armed_Auto and Armed_Retrigger have been selected, generation of signals can be stopped with the Arm button. A new trigger (internally with Execute Trigger or externally) causes a restart.

Stopped The signal is not generated, and the instrument waits for a trigger event (internal or external).

Arm

Stops signal generation. This button appears only with **Running** signal generation in the **Armed_Auto** and **Armed_Retrigger** trigger modes.

Signal generation can be restarted by a new trigger (internally with **Execute Trigger** or externally).

Remote-control command:
`SOUR:BB:WLAN:TRIG:ARM:EXEC`

Execute Trigger (Trigger Source Internal only)

Executes trigger manually. A manual trigger can be executed only when an internal trigger source and a trigger mode other than Auto have been selected.

Remote-control commands:
`SOUR:BB:WLAN:TRIG:SOUR INT`
`SOUR:BB:WLAN:SEQ RETR`
`SOUR:BB:WLAN:TRIG:EXEC`

Trigger Source

Selects trigger source. This setting is effective only when a trigger mode other than Auto has been selected.

Internal

The trigger event is executed by **Execute Trigger**.

Remote-control command::
`SOUR:BB:WLAN:TRIG:SOUR INT`

Internal (Baseband A/B)

The trigger event is executed by the trigger signal from the second path (two-path instruments only).

Remote-control command:
`SOUR:BB:WLAN:TRIG:SOUR OBAS`

External (TRIGGER 1 / 2)

The trigger event is executed with the aid of the active edge of an external trigger signal. The trigger signal is supplied via the TRIGGER 1 or TRIGGER 2 connector.

The polarity, the trigger threshold and the input impedance of the TRIGGER input can be set in the **Global Trigger/Clock Settings** menu.

Remote-control command:
`SOUR:BB:WLAN:TRIG:SOUR EXT | BEXT`

External / Trigger Delay (only Trigger Source External / Internal Other baseband)

Sets trigger signal delay in chips on external triggering or on internal triggering via the second path. This enables the R&S Vector Signal Generator to be synchronized with the device under test or other external devices.

Note *The delay can be set separately for each of the two paths.*

Remote-control command::
`SOUR:BB:WLAN:TRIG:EXT:DEL 3`
`SOUR:BB:WLAN:TRIG:OBAS:DEL 3`

External / Trigger Inhibit (only Trigger Source External / Internal Other baseband)

Sets the duration for inhibiting a new trigger event subsequent to triggering. The input is to be expressed in chips.
In the **Retrigger** mode every trigger signal causes signal generation to restart. This restart is inhibited for the specified number of chips.
This parameter is only available on external triggering or on internal triggering via the second path.

Note: *The trigger inhibit can be set separately for each of the two paths.*

Remote-control command:
`SOUR:BB:WLAN:TRIG:EXT:INH 1000`
`SOUR:BB:WLAN:TRIG:OBAS:INH 1000`

The marker output signal for synchronizing external instruments is configured in the **Marker Settings** section **Marker Mode**.

Marker x Mode - Selects a marker signal for the associated MARKER output.

Restart

A marker signal is generated at the start of each signal sequence (period = selected number of frames).

Remote-control command:
`SOUR:BB:WLAN:TRIG:OUTP1:MODE REST`

Frame Start

A marker signal is generated at the start of each frame (period = PPDU + idle time).

Remote-control command:
`SOUR:BB:WLAN:TRIG:OUTP1:MODE FRAM`

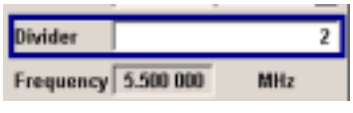
Frame Active

A marker signal is generated at the start of every active part of the frame.
The active data transfer part (PPDU) of a frame period is marked with high, the inactive part (idle time) with low. This marker can be used to decrease the carrier leakage during inactive signal parts by feeding it into the pulse modulator.

Remote-control command:
`SOUR:BB:WLAN:TRIG:OUTP1:MODE FACT`

Pulse

A regular marker signal is generated. The clock frequency is defined by entering a divider. The frequency is derived by dividing the chip rate by the divider. The input box for the divider opens when **Pulse** is selected, and the resulting pulse frequency is displayed below it.



Remote-control commands:
`SOUR:BB:WLAN:TRIG:OUTP1:MODE PULS`
`SOUR:BB:WLAN:TRIG:OUTP1:PULS:DIV 4`
`SOUR:BB:WLAN:TRIG:OUTP1:PULS:FREQ?`

Pattern

A marker signal that is defined by a bit pattern is generated. The pattern has a maximum length of 32 bits and is defined in an input field which opens when **pattern** is selected.

Remote-control commands:
`SOUR:BB:WLAN:TRIG:OUTP1:MODE PATT`
`SOUR:BB:WLAN:TRIG:OUTP1:PATT #B1111,4`

ON/OFF ratio A regular marker signal that is defined by an ON/OFF ratio is generated. A period lasts one ON and OFF cycle.

The ON time and OFF time are each expressed as a number of symbols and are set in an input field which opens when **ON/OFF ratio** is selected.

Remote-control commands:
```
SOUR:BB:WLAN:TRIG:OUTP1:MODE RAT
SOUR:BB:WLAN:TRIG:OUTP1:OFFT 20
SOUR:BB:WLAN:TRIG:OUTP1:ONT  20
```

The **Marker Delay** section can be used to set a delay for the markers.

Marker x Enters the delay between the marker signal at the marker outputs and the start of the signal.
The input is expressed as a number of chips.
If the setting "**Fix marker delay to dynamic range**" is enabled, the setting range is restricted to the dynamic range. In this range the delay of the marker signals can be set without restarting the marker and signal.

Remote-control command:
```
SOUR:BB:WLAN:TRIG:OUTP2:DEL 20
```

Current Range without Calculation Displays the dynamic range within which the delay of the marker signals can be set without restarting the marker and signal.
The delay can be defined by moving the setting mark.

Remote-control command:
```
SOUR:BB:WLAN:TRIG:OUTP2:DEL:MAX?
SOUR:BB:WLAN:TRIG:OUTP2:DEL:MIN?
```

Fix marker delay to current range Restricts the marker delay setting range to the dynamic range. In this range the delay can be set without restarting the marker and signal.

Remote-control command:
```
SOUR:BB:WLAN:TRIG:OUTP:DEL:FIX ON
```

The clock source is selected in the **Clock Settings** section.

Clock Source

Selects the clock source (also see section "*Clock Signals*").

Intern

The internal clock reference is used to generate the chip clock.

Remote-control command:
`SOUR:BB:WLAN:CLOC:SOUR INT`

Extern

The external clock reference is fed in as the chip clock or multiple thereof via the CLOCK connector.

The chip rate must be correctly set to an accuracy of ± 2 % (see data sheet).

The polarity of the clock input can be changed with the aid of **Global Trigger/Clock Settings**.

In the case of two-path instruments this selection applies to path A.

Remote-control command:
`SOUR:BB:WLAN:CLOC:SOUR EXT`

Clock Mode (for external clock source only)

Enters the type of externally supplied clock.

Chip

A chip clock is supplied via the CLOCK connector.

Remote-control command:
`SOUR:BB:WLAN:CLOC:MODE CHIP`

Multiple

A multiple of the chip clock is supplied via the CLOCK connector; the chip clock is derived internally from this.

The **Multiplier** window provided allows the multiplication factor to be entered.

Remote-control command:
`SOUR:WIM:CLOC:MODE MCH`

Chip Clock Multiplier

Enters the multiplication factor for clock type **Multiple**.

Remote-control command:
`SOUR:BB:WLAN:CLOC:MULT 4`

Measured External Clock (Clock Source External only)

Displays the measured frequency of the external clock signal. This enables the user to permanently monitor the frequency of the externally introduced clock.

This information is displayed only if the external clock source has been selected.

Remote-control command:
`:CLOC:INP:FREQ?`

Global Trigger/Clock Settings

Calls the **Global Trigger/Clock/Input Settings** menu. This menu is used among other things for setting the trigger threshold, the input impedance and the polarity of the clock and trigger inputs
In the case of two-path instruments these settings are valid for both paths.

The parameters in this menu affect all digital modulations and standards, and are described in the section "*Global Trigger/Clock/Input Settings – Setup -Environment* ".

User Marker AUX I/O Settings

Calls the **User Marker AUX I/O Settings** menu. This menu is used to map the connector on the rear of the instruments, see section "*User Marker - AUX IO - Setup-Environment-Global...Settings* ".

SOURce:BB:WLAN Subsystem Remote-Control Commands

WLAN - General Remote-Control Commands

This subsystem contains commands for the primary and general settings of the IEEE 802.11a-g WLAN standard. These settings concern activation and deactivation of the standard, setting the transmission direction, filter, clock, trigger and clipping settings, defining the frame duration and the sequence length, as well as the preset setting.
The commands for defining the frame configuration for physical layer modes OFDM and CCK/PBCC are described in the next section. The commands are divided up in this way to make the comprehensive `SOURce:BB:WLAN` subsystem clearer.

The numerical suffix at SOURce distinguishes between path A and path B for two-path instruments:
SOURce<1> = path A
SOURce2 = path B

The keyword SOURce is optional with commands for path A and can be omitted. For path B, the command must include the keyword with the suffix 2.

Command	Parameters	Default unit	Comments
[SOURce<[1]|2>:]BB:WLAN:CLIPping:LEVel	1...100	PCT	
[SOURce<[1]|2>:]BB:WLAN:CLIPping:MODE	VECTor | SCALar		
[SOURce<[1]|2>:]BB:WLAN:CLIPping:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WLAN:CLOCk:MODE	CHIP | MCHip		
[SOURce<[1]|2>:]BB:WLAN:CLOCk:MULTiplier	1... 64		
[SOURce<[1]|2>:]BB:WLAN:CLOCk:SOURce	EXTernal | INTernal		
[SOURce<[1]|2>:]BB:WLAN:CRATe:VARiation	0.001 ... 100 MHz	Hz (c/s)	
[SOURce<[1]|2>:]BB:WLAN:FFORmat	DATA | RTS | CTS | ACK		
[SOURce<[1]|2>:]BB:WLAN:FILTer:PARameter:APCO25	0.15 ... 2.5		
[SOURce<[1]|2>:]BB:WLAN:FILTer:PARameter:COSine	0.05 ... 0.99		
[SOURce<[1]|2>:]BB:WLAN:FILTer:PARameter:GAUSs	0.15 ... 2.5		
[SOURce<[1]|2>:]BB:WLAN:FILTer:PARameter:PGAuss	0.15 ... 2.5		
[SOURce<[1]|2>:]BB:WLAN:FILTer:PARameter:RCOSine	0.05 ... 0.99		
[SOURce<[1]|2>:]BB:WLAN:FILTer:PARameter:SPHase	0.15 ... 2.5		
[SOURce<[1]|2>:]BB:WLAN:FILTer:TYPE	RCOSine | COSine | GAUSs | LGAuss | CONE | COF705 | COEQualizer | COFequalizer | C2K3x | APCO25 | SPHase | RECTangle | PGAuss		
[SOURce<[1]|2>:]BB:WLAN:ILEaver:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WLAN:ITIMe	0.0 .... 1E-1		
[SOURce<[1]|2>:]BB:WLAN:PLCP:FORMat	LONG | SHORt		
[SOURce<[1]|2>:]BB:WLAN:PLCP:LCBit:STATe	ON | OFF		

Command	Parameters	Default unit	Comments
[SOURce<[1]|2>:]BB:WLAN:MODE	OFDM | CCK | PBCC		
[SOURce<[1]|2>:]BB:WLAN:PRESet			No query
[SOURce<[1]|2>:]BB:WLAN:SCRambler:MODE	ON | OFF | RANDom | USER | PONLy		
[SOURce<[1]|2>:]BB:WLAN:SCRambler:PATTern	0x0 .. 0xFF		
[SOURce<[1]|2>:]BB:WLAN:SEQuence	AUTO | RETRigger | AAUTo | ARETrigger | SINGle		
[SOURce<[1]|2>:]BB:WLAN:SERVice:PATTern	0x0 .. 0xFFFF		
[SOURce<[1]|2>:]BB:WLAN:SETTing:CATalog?			Query only
[SOURce<[1]|2>:]BB:WLAN:SETTing:DELete	<file_name>		
[SOURce<[1]|2>:]BB:WLAN:SETTing:LOAD	<file_name>		
[SOURce<[1]|2>:]BB:WLAN:SETTing:STORe	<file_name>		
[SOURce<[1]|2>:]BB:WLAN:SLENgth	1... MAX		
[SOURce<[1]|2>:]BB:WLAN:SMODe	FRAMed | UNFRamed		
[SOURce<[1]|2>:]BB:WLAN:STANdard	STAN80211A | STAN80211B | STAN80211G		
[SOURce<[1]|2>:]BB:WLAN:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WLAN::TDWindowing:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WLAN:TRIGger:ARM:EXECute			No query
[SOURce<[1]|2>:]BB:WLAN:TRIGger:EXECute			No query
[SOURce<[1]|2>:]BB:WLAN:TRIGger[:EXTernal<[1]|2>]:DELay	0 ...(2^32 - 1) chips		
[SOURce<[1]|2>:]BB:WLAN:TRIGger[:EXTernal<[1]|2>]:INHibit	0 ...(2^32 - 1) chips		
[SOURce<[1]|2>:]BB:WLAN:TRIGger:OBASeband:DELay	0 ...(2^32 - 1) chips		
[SOURce<[1]|2>:]BB:WLAN:TRIGger:OBASeband:INHibit	0 ...(2^32 - 1) chips		
[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut<[1]...4>:DELay	0 ...(2^32 - 1) chips		
[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut:DELay:FIXed	ON | OFF	Hz	
[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut<[1]...4>:DELay:MAXimum			Query only
[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut<[1]...4>:DELay:MINimum			Query only
[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut<[1]...4>:MODE	RESTart | FRAMe | PULSe | PATTern | RATio		
[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut<[1]...4>:OFFTime	2 ... (2^24 - 1) chips		
[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut<[1]...4>:ONTime	2 ... (2^24 - 1) chips		
[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut<[1]...4>:PATTern	#B0,1...#B111..1,32		
[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut<[1]...4>:PULSe:DIVider	2 ... 1024		
[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut<[1]...4>:PULSe:FREQuency			Query only
[SOURce<[1]|2>:]BB:WLAN:TRIGger:RMODe			Query only
[SOURce<[1]|2>:]BB:WLAN:TRIGger:SLENgth	0 ...(2^32 - 1) chips		
[SOURce<[1]|2>:]BB:WLAN:TRIGger:SLUNit	FRAMe | CHIP | SEQuence		
[SOURce<[1]|2>:]BB:WLAN:TRIGger:SOURce	EXTernal | INTernal | BEXTernal | OBASeband		
[SOURce<[1]|2>:]BB:WLAN:TTIMe	0 ... 1000.0 ns	s	

[SOURce<[1]|2>:]BB:WLAN:CLIPping:LEVel 0 ... 100 PCT

The command sets the limit for level clipping. This value indicates at what point the signal is clipped. It is specified as a percentage, relative to the highest level. 100% indicates that clipping does not take place.

Level clipping is activated with the command `SOUR:BB:WLAN:CLIP:STAT ON`

Example: `"BB:WLAN:CLIP:LEV 80PCT"` 'sets the limit for level clipping to 80% of the maximum level.

`"BB:WLAN:CLIP:STAT ON"` 'activates level clipping.

*RST value	Resolution	Options	SCPI
100 PCT	1	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:CLIPping:MODE VECTor | SCALar

The command sets the method for level clipping (Clipping).

Parameters:

VECTor The reference level is the amplitude | i+jq |

SCALar The reference level is the absolute maximum of the I and Q values.

Example: `"BB:WLAN:CLIP:MODE SCAL"` 'selects the absolute maximum of all the I and Q values as the reference level.

`"BB:WLAN:CLIP:LEV 80PCT"` 'sets the limit for level clipping to 80% of this maximum level.

`"BB:WLAN:CLIP:STAT ON"` 'activates level clipping.

*RST value	Resolution	Options	SCPI
VECTor	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:CLIPping:STATe ON | OFF

The command activates level clipping (Clipping). The value is defined with the command `[SOURce:]BB:WLAN:CLIPping:LEVel`, the mode of calculation with the command `[SOURce:]BB:WLAN:CLIPping:MODE` .

Example: `"BB:WLAN:CLIP:STAT ON"` 'activates level clipping.

*RST value	Resolution	Options	SCPI
OFF		B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:CLOCk:MODE CHIP | MCHip

The command enters the type of externally supplied clock (`:BB:WLAN:CLOCk:SOURce EXTernal`).

When `MCHip` is used, a multiple of the chip clock is supplied via the CLOCK connector and the chip clock is derived internally from this. The multiplier is entered with the command `:BB:WLAN:CLOCk:MULTiplier`.

With this command the only numerical suffix allowed for SOURce is 1, since the external clock source is permanently allocated to path A.

Example: `"BB:WLAN:CLOC:MODE CHIP"` 'selects clock type **Chip**, i.e. the supplied clock is a chip clock.

*RST value	Resolution	Options	SCPI
CHIP	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:CLOCk:MULTiplier 1 ... 64

The command specifies the multiplier for clock type **Multiplied** (`:BB:WLAN:CLOCk:MODE MCHip`) in the case of an external clock source.

With this command the only numerical suffix allowed for SOURce is 1, since the external clock source is permanently allocated to path A.

Example: `"BB:WLAN:CLOC:SOUR EXT"` 'selects the external clock source. The clock is supplied via the CLOCK connector.

`"BB:WLAN:CLOC:MODE MCH"` 'selects clock type **Multiplied**, i.e. the supplied clock has a rate which is a multiple of the chip rate.

`"BB:WLAN:CLOC:MULT 12"` 'the multiplier for the external clock rate is 12.

*RST value	Resolution	Options	SCPI
4	1	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:CLOCk:SOURce INTernal | EXTernal

The command selects the clock source.

Selecting EXTernal is only possible for path A, since the external clock source is permanently allocated to path A.

Parameter:

INTernal The internal clock reference is used.

EXTernal The external clock reference is supplied to the CLOCK connector.

Example:

```
"BB:WLAN:CLOC:SOUR EXT"
```
'selects an external clock reference..

```
"BB:WLAN:CLOC:MODE CHIP"
```
'specifies that a chip clock is supplied via the CLOCK connector.

*RST value	Resolution	Options	SCPI
INTernal	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:CRATe:VARiation 1 kcps ... 100 Mcps

The command enters the output chip rate.

Example:

```
"BB:WLAN:CRAT:VAR 4086001"
```
"sets the output chip rate to 4.08 Mcps.

*RST value	Resolution	Options	SCPI
802.11a: 20 Mcps 802.11b: 11 Mcps 802.11g: 11 Mcps	1 Hz	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:FFORmat DATA | RTS | CTS | ACK

The command selects the frame type. The selection defines parameters of the MAC layer, e.g. the values of the MAC Header bit fields. The command is only valid in framed mode (`SOURce:BB:WLAN:SMODe FRAMed`).

Parameter:

DATA Predefined settings for data transmission

RTS Predefined settings for Request to Send.

CTS Predefined settings for Clear to Send.

ACK Predefined settings for Acknowledgement.

Example:

```
"BB:WLAN:SMOD FRAM"
```
'selects framed mode

```
"BB:WLAN:FFOR RTS"
```
'selects frame type RTS

*RST value	Resolution	Options	Dependencies	SCPI
DATA	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	The selection defines parameters of the MAC layer, e.g. the values of the MAC Header bit fields	Device-specific

[SOURce<[1]|2>:]BB:WLAN:FILTer:PARameter:APCO25 0.05 ... 0.99

The command sets the roll-off factor for filter type APCO25.

Example: `"BB:WLAN:FILT:PAR:APCO25 0.2"` 'sets the roll-off factor to 0.2 for filter type APCO25.

*RST value	Resolution	Options	SCPI
0.20	0.01	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:FILTer:PARameter:COSine 0.05 ... 0.99

The command sets the roll-off factor for the Cosine filter type.

Example: `"BB:WLAN:FILT:PAR:COS 0.5"` 'sets the roll-off factor to 0.35 for filter type Cosine.

*RST value	Resolution	Options	SCPI
0.35	0.01	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:FILTer:PARameter:PGAuss 0.15 ... 2.5

The command sets the roll-off factor for the Pure Gauss filter type.

Example: `"BB:WLAN:FILT:PAR:GAUS 0.5"` 'sets B x T to 0.5 for the Pure Gauss filter type.

*RST value	Resolution	Options	SCPI
0.5	0.01	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:FILTer:PARameter:GAUSs 0.15 ... 2.5

The command sets the roll-off factor for the Gauss filter type.

Example: `"BB:WLAN:FILT:PAR:COS 0.5"` 'sets B x T to 0.5 for the Gauss filter type.

*RST value	Resolution	Options	SCPI
0.5	0.01	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[

SOURce<[1]|2>:]BB:WLAN:FILTer:PARameter:RCOSine 0.05 ... 0.99

The command sets the roll-off factor for the Root Cosine filter type.

Example: `"BB:WLAN:FILT:PAR:RCOS 0.22"` 'sets the roll-off factor to 0. 22 for filter type Root Cosine.

*RST value	Resolution	Options	SCPI
0.22	0.01	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:FILTer:PARameter:SPHase 0.15 ... 2.5

The command sets B x T for the Split Phase filter type

Example: `"BB:WLAN:FILT:PAR:SPH 0.5"` 'sets B x T to 0.5 for the Split Phase filter type.

*RST value	Resolution	Options	SCPI
2.00	0.01	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:FILTer:TYPE RCOSine | COSine | GAUSs | LGAuss | CONE | COF705 | COEQualizer | COFequalizer | C2K3x | APCO25 | SPHase | RECTangle | PGAuss

The command selects the filter type. .

Example: `"BB:WLAN:FILT:TYPE COS"` 'sets the filter type COSine.

*RST value	Resolution	Options	SCPI
GAUSs	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:ILEaver:STATe ON | OFF

The command activates/deactivates the interleaver. This command is only available in physical layer mode OFDM (`SOURce:BB:WLAN:MODE OFDM`).

Example: `"BB:WLAN:STAN STAN80211g"` 'selects standard 802.11g

`"BB:WLAN:MODE OFDM"` 'selects physical layer mode OFDM

`"BB:WLAN:ILE:STAT ON"` 'activates the interleaver

*RST value	Resolution	Options	SCPI
ON	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:ITIMe 0 ... 0.01 s

The command the idle time, i.e. the time between two PPDU bursts. This command is only available for framed mode (`SOURce:BB:WLAN:SMODe FRAMed`).

Example: `"BB:WLAN:ITIM 10us"` 'sets an idle time of 10 us

*RST value	Resolution	Options	SCPI
100 us	1 us	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:MODE OFDM | CCK | PBCC

The command selects the Physical Layer Mode.

Parameter:

OFDM The OFDM (orthogonal frequency division multiplexing) physical layer supports a frame-based transmission. The OFDM (orthogonal frequency division multiplexing) signal is divided into 52 carriers. The symbol rate of the modulation on the individual carriers is 250 kHz. A user data rate of up to 54 Mbps at a channel bandwidth of 20 MHz can be obtained by combining 48 useful carriers for data transmission (4 carriers are used for pilots) and using 64QAM for subcarrier modulation. With OFDM, the individual carriers are superimposed mutually orthogonal, which, in the ideal case, does not cause any intercarrier interference (ICI).

CCK The CCK (complementary code keying) physical layer mode is used for the 5.5 Mbps and 11 Mbps data rates.

PBCC The PBCC (packet binary convolutional coding) physical layer can optionally be used instead of CCK modulation.

Example: `"BB:WLAN:MODE OFDM"` 'selects physical layer mode OFDM

*RST value	Resolution	Options	SCPI
OFDM	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PLCP:FORMat LONG | SHORt

The command selects the packet type (PPDU format) with long or short PLCP (physical layer convergence protocol). Depending on the format selected, the structure, modulation and data rate of the PLCP preamble and header are modified. The command is only available in framed mode (`SOURce:BB:WLAN:SMODe FRAMed`) and for physical layer mode CCK and PBCC (`SOURce:BB:WLAN:MODE CCK|PBCC`).

Example: `"BB:WLAN:PLCP:FORM LONG"` 'selects the packet type (PPDU format) with long PLCP.

*RST value	Resolution	Options	SCPI
LONG	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PLCP:LCBit:STATe ON | OFF

The command sets the Locked Clock Bit in Service Field of the PLCP Header.. The command is only available in framed mode (`SOURce:BB:WLAN:SMOD FRAMed`) and for physical layer mode CCK and PBCC (`SOURce:BB:WLAN:MODE CCK|PBCC`).

Example: `"BB:WLAN:PLCP:LCB:STAT OFF"` 'disables the Locked Clock Bit.

*RST value	Resolution	Options	SCPI
ON	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PRESet

The command produces a standardized default for the IEEE 802.11a-g standard. The settings correspond to the *RST values specified for the commands. .

This command triggers an action and therefore has no *RST value and no query form.

Example: `"BB:WLAN:PRES"` 'resets all the IEEE 802.11a-g settings to default values.

*RST value	Resolution	Options	Dependencies	SCPI
-	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	All IEEE 802.11a-g settings are preset.	Device-specific

[SOURce<[1]|2>:]BB:WLAN:SCRambler:MODE
OFF | RANDom | USER (OFDM) OFF | ON | PONLy (CCK / PBCC)

The command activates/deactivates the scrambler and selects the mode of determining the initialization value. The valid parameters depend on the selected physical layer mode (`SOURce:BB:WLAN:MODE OFDM | CCK|PBCC`)

Parameter:

OFF The scrambler is deactivated.

RANDom `(OFDM only)`The scrambler is activated. The initialization value of the scrambler is selected at random. Each frame has a different random initialization value. This value is also different in case of successive recalculations with the same setting parameters so that different signals are generated for each calculation.

USER `(OFDM only)`The scrambler is activated. The initialization value of the scrambler is set to a fixed value that is entered at **Scrambler Init (hex)** . This value is then identical in each generated frame.

ON `(CCK | PBCC only)`The scrambler is activated.

PONLy `(CCK | PBCC only)`The scrambler is activated. Only the data of the preamble is scrambled.

Example: "BB:WLAN:SCR:MODE OFF" 'the scrambler is deactivated.

*RST value	Resolution	Options	SCPI
OFDM: RANDom CCK/PBCC: ON	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:SCRambler:PATTern #H0,0 ... #HFF,8

The command enters the initialization value for scrambling mode User. This value is then identical in each generated frame. The command is only available for physical layer mode OFDM (SOURce:BB:WLAN:MODE OFDM)

Example: "BB:WLAN:SCR:MODE USER" 'the scrambler is activated.

"BB:WLAN:SCR:PATT #H3F,8" 'the initialization value is set.

*RST value	Resolution	Options	SCPI
#H0,0	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:SERVice:PATTern #H0,0 ... #HFF,8

The command enters the value for service fieldThe command is only available for physical layer mode OFDM (SOURce:BB:WLAN:MODE OFDM)

Example: "BB:WLAN:SERV:PATT #H3F,8" 'the value for the service field is set.

*RST value	Resolution	Options	SCPI
#H0,0	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:SEQuence AUTO | RETRigger | AAUTo | ARETrigger | SINGle

The command selects the trigger mode.

Parameter:

AUTO The modulation signal is generated continuously.

RETRigger The modulation signal is generated continuously. A trigger event (internal or external) causes a restart.

AAUTo The modulation signal is generated only when a trigger event occurs. After the trigger event the signal is generated continuously. Signal generation is stopped with command SOUR:BB:WLAN:TRIG:ARM:EXEC and started again when a trigger event occurs.

ARETrigger The modulation signal is generated only when a trigger event occurs. The device automatically toggles to RETRIG mode. Every subsequent trigger event causes a restart.
Signal generation is stopped with command `SOUR:BB:WLAN:TRIG:ARM:EXEC` and started again when a trigger event occurs.

SINGle The modulation signal is generated only when a trigger event occurs. Then the signal is generated once to the length specified with command `SOUR:BB:WLAN:TRIG:SLEN`. Every subsequent trigger event causes a restart.

Example: `"BB:WLAN:SEQ AAUT"` 'sets the **Armed_auto** trigger mode; the device waits for the first trigger (e.g. with `*TRG`) and then generates the signal continuously.

*RST value	Resolution	Options	SCPI
AUTO	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:SETTing:CATalog?

This command reads out the files with IEEE 802.11a-g settings in the default directory. The default directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. Only files with the file extension ***.wlan** will be listed.

The command is a query command and therefore has no *RST value.

Example: `"MMEM:CDIR 'D:\user\wlan"` 'sets the default directory to D:\user\wlan.

`"BB:WLAN:SETT:CAT?"` 'reads out all the files with IEEE 802.11a-g settings in the default directory.

Response: `"'wlana','wlang'"` 'the files `''wlana'` and `'wlang''` are available.

*RST value	Resolution	Options	SCPI
	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:SETTing:DELete <file_name>

This command deletes the selected file with IEEE 802.11a-g WLAN settings The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. The file extension may be omitted. Only files with the file extension ***.wlan** will be deleted.

This command triggers an event and therefore has no *RST value and no query form.

Example: `"BB:WLAN:SETT:DEL 'wlana'"` 'deletes file '`wlana`'.

*RST value	Resolution	Options	SCPI
	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:SETTing:LOAD <file_name>

This command loads the selected file with IEEE 802.11a-g WLAN settings The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. The file extension may be omitted. Only files with the file extension ***.wlan** will be loaded.

This command triggers an event and therefore has no *RST value and no query form.

Example: `"BB:WLAN:SETT:LOAD 'wlana'"` 'loads file '`wlana`'.

*RST value	Resolution	Options	SCPI
	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:SETTing:STORe <file_name>

This command stores the current IEE 802.11a-g WLAN settings into the selected file The directory is set using command `MMEM:CDIRectory`. A path can also be specified, in which case the files in the specified directory are read. Only the file name has to be entered. IEE 802.11a-g WLAN settings are stored as files with the specific file extensions ***.wlan**.

This command triggers an event and therefore has no *RST value and no query form.

Example: `"BB:WLAN:SETT:STOR 'wlan_g'"`
'stores the current settings into file '`wlan_g`'.

*RST value	Resolution	Options	SCPI
	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:SLENgth 1 ... 511 frames

The command selects the number of frames. The command is only valid in framed mode (`SOURce:BB:WLAN:SMODe FRAMed`).

Example: `"BB:WLAN:SLEN 4"` 'selects the generation of 4 frames.

*RST value	Resolution	Options	SCPI
1	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:SMODe FRAMed | UNFRamed

The command selects the simulation mode.

Parameter:

FRAMed The **framed mode** is the standard operating mode which is also used in the real system. Data packets with the frame structure defined by the standard are generated.

UNFRamed The **unframed mode** is offered in addition. In this mode, a non-packet-oriented signal without a frame structure is generated with the modulations and data rates defined by 802.11a-g.

Example: `"BB:WLAN:SMOD UNFR"` 'selects unframed mode.

*RST value	Resolution	Options	SCPI
FRAMed	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:STANdard STAN80211A | STAN80211B | STAN80211G

The command selects the standard according to which the signal is simulated.

Parameter:

STAN80211A The standard supports OFDM (orthogonal frequency division multiplexing). This modulation is defined by the IEEE 802.11a specification in the 5 GHz frequency band.

STAN80211B The standard includes the modulation mode CCK (complementary code keying) and the data rates 5.5 Mbps and 11 Mbps. PBCC (packet binary convolutional coding) can optionally be used instead of CCK modulation for the 5.5 Mbps and 11 Mbps data rates.

STAN80211G Standard 802.11g extends standard 802.11b with higher transmission rates. 802.11g contains the previous 802.11b modes and also integrates the OFDM method used in 802.11a for frequencies in the 2.4 GHz band.

Example: `"BB:WLAN:STAN STAN80211B"` 'selects signal generation according to 802.11b.

*RST value	Resolution	Options	SCPI
STAN80211G	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:STATe ON | OFF

The command activates modulation in accordance with the IEE 802.11a-g WLAN standard. Activating this standard deactivates all the other digital standards and digital modulation modes on the same path.

Example: `"BB:WLAN:STAT ON"` 'activates modulation in accordance with the IEE 802.11a-g WLAN standard.

*RST value	Resolution	Options	Dependencies	SCPI
OFF	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	`BB:WLAN:STAT ON` deactivates the other standards and digital modulation.	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TDWindowing:STATe ON | OFF

The command activates/deactivates the time domain windowing. Time domain windowing is a method to influence the spectral characteristics of the signal, which is not stipulated by the standard. However, it does not replace oversampling and subsequent signal filtering. The command is only available for physical layer mode OFDM (`SOURce:BB:WLAN:MODE OFDM`).

Example: `"BB:WLAN:TDW:STAT OFF"` 'deactivates the time domain windowing.

*RST value	Resolution	Options	SCPI
OFF		B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger:ARM:EXECute

The command stops signal generation for trigger modes Armed_Auto and Armed_Retrigger. A subsequent internal or external trigger event restart signal generation.

This command triggers an event and therefore has no *RST value and no query form.

Example: `"BB:WLAN:TRIG:SOUR INT"` 'sets internal triggering.

`"BB:WLAN:TRIG:SEQ ARET"` 'sets Armed_Retrigger mode, i.e. every trigger event causes signal generation to restart.

`"BB:WLAN:TRIG:EXEC"` 'executes a trigger, signal generation is started.

`"BB:WLAN:TRIG:ARM:EXEC"` 'signal generation is stopped.

`"BB:WLAN:TRIG:EXEC"` 'executes a trigger, signal generation is started again.

*RST value	Resolution	Options	SCPI
		B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger:EXECute

The command executes a trigger. The internal trigger source must be selected using the command `:BB:WLAN:TRIG:SOUR INT` and a trigger mode other than `AUTO` must be selected using the command `:BB:WLAN:TRIG:SEQ`.

This command triggers an event and therefore has no *RST value and no query form.

Example:
```
"BB:WLAN:TRIG:SOUR INT"      'sets internal triggering.
"BB:WLAN:TRIG:SEQ RETR"      'sets Retrigger mode, i.e. every trigger event causes signal generation to restart.
"BB:WLAN:TRIG:EXEC"          'executes a trigger.
```

*RST value	Resolution	Options	SCPI
		B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger[:EXTernal<[1]|2>]:DELay 0 ... 2^32-1

The command specifies the trigger delay (expressed as a number of chips) for external triggering. The numeric suffix to EXTernal distinguishes between the external trigger via the TRIGGER 1 (suffix 1) and TRIGGER 2 (suffix 2) connector.

Example:
```
"BB:WLAN:TRIG:SOUR EXT"      'sets an external trigger via the TRIGGER 1 connector.
"BB:WLAN:TRIG:DEL 50"        'sets a delay of 50 chips for the trigger.
```

*RST value	Resolution	Options	SCPI
0 chips	1 chip	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger[:EXTernal<[1]|2>]:INHibit 0 ... 2^32-1

The command specifies the number of chips by which a restart is to be inhibited following a trigger event. This command applies only in the case of external triggering. The numeric suffix to EXTernal distinguishes between the external trigger via the TRIGGER 1 (suffix 1) and TRIGGER 2 (suffix 2) connector.

Example:
```
"BB:WLAN:TRIG:SOUR EXT"      'selects an external trigger via the TRIGGER 1 connector
"BB:WLAN:TRIG:INH 200"       'sets a restart inhibit for 200 chips following a trigger event.
```

*RST value	Resolution	Options	SCPI
0 chips	1 chip	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger:OBASeband:DELay 0 ... 2^32-1

The command specifies the trigger delay (expressed as a number of chips) for triggering by the trigger signal from the second path (two-path instruments only).

Example:
```
"BB:WLAN:TRIG:SOUR OBAS"      'sets for path A the internal trigger executed by the trigger signal from the second path (path B).
"BB:WLAN:TRIG:OBAS:DEL 50"    'sets a delay of 50 chips for the trigger.
```

*RST value	Resolution	Options	SCPI
0 chips	1 chips	B10/B11 and B13 K48Only with second option B13	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger:OBASband:INHibit 0 ... 2^32-1

The command specifies the number of chips by which a restart is to be inhibited following a trigger event. This command applies only for triggering by the second path (two-path instruments only).

Example:
```
"BB:WLAN:TRIG:SOUR OBAS"      'sets for path A the internal trigger executed by the trigger signal from the second path (path B).
"BB:WLAN:TRIG:INH 200"        'sets a restart inhibit for 200 chips following a trigger event.
```

*RST value	Resolution	Options	SCPI
0 chips	1 chip	B10/B11 and B13 K48Only with second option B13	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut<[1]...4>:DELay 0 ... 2^32 - 1 Samples

The command defines the delay between the signal on the marker outputs and the start of the signal, expressed in terms of chips. Command `:BB:WLAN:TRIGger:OUTPut:DELay:FIXed` can be used to restrict the range of values to the dynamic range, i.e. the range within which a delay of the marker signals can be set without restarting the marker and signal.

Example:
```
"BB:WLAN:TRIG:OUTP2:DEL 1600"
                              'sets a delay of 1600 chips for the signal on connector MARKER 2.
```

*RST value	Resolution	Options	SCPI
0	1 chip	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut:DELay:FIXed ON | OFF

The command restricts the marker delay setting range to the dynamic range. In this range the delay can be set without restarting the marker and signal. If a delay is entered in setting ON but is outside this range, the maximum possible delay is set and an error message is generated.

Example: `"BB:WLAN:TRIG:OUTP:DEL:FIX ON"`
'restricts the marker signal delay setting range to the dynamic range.

*RST value	Resolution	Options	SCPI
OFF	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut<[1]...4>:DELay:MAXimum

The command queries the maximum marker delay for setting `:BB:WLAN:TRIG:OUTP:DEL:FIX ON`.

The command is a query only and therefore has no *RST value.

Example: `"BB:WLAN:TRIG:OUTP:DEL:FIX ON"`
'restricts the marker signal delay setting range to the dynamic range.

`"BB:WLAN:TRIG:OUTP:DEL:MAX"`
'queries the maximum of the dynamic range.

Response: `"2000"` 'the maximum for the marker delay setting is 2000 chips.

*RST value	Resolution	Options	SCPI
-	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut<[1]...4>:DELay:MINimum

The command queries the minimum marker delay for setting `:BB:WLAN:TRIGger:OUTPut:DELay:FIXed ON`.

The command is a query only and therefore has no *RST value.

Example: `"BB:WLAN:TRIG:OUTP:DEL:FIX ON"`
'restricts the marker signal delay setting range to the dynamic range.

`"BB:WLAN:TRIG:OUTP:DEL:MIN"`
'queries the minimum of the dynamic range.

Response: `"0"` 'the minimum for the marker delay setting is 0 chips.

*RST value	Resolution	Options	SCPI
-	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut<[1]...4>:MODE
RESTart | FRAMe | FAPart | PULSe | PATTern | RATio

The command defines the signal for the selected marker output.

Parameter:

RESTart A marker signal is generated at the start of each signal sequence (period = selected number of frames; the sequence length is set with command `SOUR:BB:WLAN:FCOunt`).

FRAMe A marker signal is generated at the start of each frame (period = PPDU + idle time).

FACTive A marker signal is generated at the start of every active part of the frame.
The active data transfer part (PPDU) of a frame period is marked with high, the inactive part (idle time) with low. This marker can be used to decrease the carrier leakage during inactive signal parts by feeding it into the pulse modulator.

PATTern A marker signal is generated according to the user defined pattern (command `SOURce:BB:WLAN:TRIGger:OUTPut:PATTern`).

PULSe A pulsed marker signal is generated. The pulse frequency (= symbol rate/divider) is defined with the `SOUR:BB:WLAN:TRIG:OUTP:PULSe:DIVider` command and can be queried with the `SOUR:BB:WLAN:TRIG:OUTP:PULSe:FREQuency?` command.

RATio A marker signal corresponding to the Time Off / Time On specifications in the commands `SOURce:BB:WLAN:TRIGger:OUTPut:OFFT` and `SOURce:BB:WLAN:TRIGger:OUTPut:ONT` is generated.

Example:
```
"BB:WLAN:TRIG:OUTP2:MODE FRAM"
```
'selects the frame marker signal on output MARKER 2.

*RST value	Resolution	Options	SCPI
RESTart	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut<[1]...4>:OFFTime 1.. 2^24 - 1 (1..16 777 215) chips

The command sets the number of chips in a period (ON time + OFF time) during which the marker signal in setting `SOURce:BB:WLAN:TRIGger:OUTPut:MODE RATio` on the marker outputs is OFF.

Example:
```
"BB:WLAN:TRIG:OUTP2:OFFT 200"
```
'sets an OFF time of 200 chips for marker signal 2 on path A.

*RST value	Resolution	Options	SCPI
1	1	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut<[1]...4>:ONTime 1.. 2^24 - 1 (1..16 777 215) chips

The command sets the number of chips in a period (ON time + OFF time) during which the marker signal in setting SOURce:BB:WLAN:TRIGger:OUTPut:MODE RATio on the marker outputs is ON.

Example: "BB:WLAN:TRIG:OUTP2:ONT 200" 'sets an ON time of 200 chips for marker 2 on path A.

*RST value	Resolution	Options	SCPI
1	1	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut<[1]...4>:PATTern #B0,1 ... #B111...1, 2

The command defines the bit pattern used to generate the marker signal in the setting SOURce:BB:WLAN:TRIGger:OUTPut:MODE PATTern. 0 is marker off, 1 is marker on

Example: "BB:WLAN:TRIG:OUTP2:PATT #B000000011111111,15" 'sets a bit pattern.

"BB:WLAN:TRIG:OUTP2:MODE PATT" 'activates the marker signal according to a bit pattern on output MARKER 2.

*RST value	Resolution	Options	SCPI
#B,1	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut<[1]...4>:PULSe:DIVider 2 ... 2^10

The command sets the divider for Pulse marker mode (SOUR:BB:WLAN:TRIG:OUTP:MODE PULSe.). The resulting pulse frequency is derived by dividing the symbol rate by the divider.

Example: "BB:WLAN:TRIG:OUTP2:PULS:DIV 2" 'sets the divider to 2 for the path A marker signal on output MARKER 2.

"BB:WLAN:TRIG:OUTP2:FREQ?" 'queries the resulting pulse frequency of the marker signal.

Response: "66 000" 'the resulting pulse frequency is 66 kHz.

*RST value	Resolution	Options	SCPI
2	1	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger:OUTPut<[1]...4>:PULSe:FREQuency?

The command queries the pulse frequency of the pulsed marker signal in the setting `SOURce:BB:WLAN:TRIGger:OUTPut:MODE PULSe`. The pulse frequency is derived by dividing the symbol rate by the divider.

The command is a query command and therefore has no *RST value.

Example:

```
"BB:WLAN:TRIG:OUTP2:PULS:DIV 2"   'sets the divider for the path A marker signal on output MARKER 2 to the value 2.
"BB:WLAN:TRIG:OUTP2:MODE PULS"    'enables the pulsed marker signal.
"BB:WLAN:TRIG:OUTP2:PULS:FREQ?"   'queries the pulse frequency of the marker signal.
Response: "33 000"                'the resulting pulse frequency is 33 kHz.
```

*RST value	Resolution	Options	SCPI
-	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger:RMODe

The command queries the current status of signal generation for all trigger modes with IEEE 802.11a-g WLAN modulation on.

The command is a query command and therefore has no *RST value.

Parameter:

RUN the signal is generated. A trigger event occurred in the triggered mode.

STOP the signal is not generated. A trigger event did not occur in the triggered modes, or signal generation was stopped by the command `:BB:WLAN:TRIG:ARM:EXECute` (armed trigger modes only).

Example:

```
"SOUR2:BB:WLAN:TRIG:SOUR EXT"     'sets external triggering via the TRIGGER 1 connector for path B of a two-path instrument.
"SOUR2:BB:WLAN:TRIG:MODE ARET"    'selects the Armed_Retrigger mode
"SOUR2:BB:WLAN:TRIG:RMOD?"        'queries the current status of signal generation.
Response: "RUN"                   'the signal is generated, an external trigger was executed.
```

*RST value	Resolution	Options	SCPI
-	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger:SLENgth 1 … (2^32-1) chips

The command defines the length of the signal sequence to be output in the **Single** trigger mode (SOUR:BB:WLAN:SEQ SING). The input is made in terms of chips.

It is possible to output deliberately just part of the frame, an exact sequence of the frame, or a defined number of repetitions of the frame.

Example:

```
"SOUR2:BB:WLAN:SEQ SING"
```
'sets trigger mode Single .

```
"SOUR2::BB:WLAN:TRIG:SLEN 200"
```
'sets a sequence length of 200 chips. The first 200 chips of the current frame will be output after the next trigger event.

*RST value	Resolution	Options	SCPI
32 768 chips	1 chip	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce:]BB:WLAN:TRIGger:SLUNit FRAMe | CHIP | SEQuence

The command defines the unit for the entry of the length of the signal sequence (SOUR:BB:WLAN:TRIG:SLEN) to be output in the **Single** trigger mode (SOUR:BB:WLAN:SEQ SING).

Parameter:

FRAMe Unit Frame. A single frame is generated after a trigger event.

CHIP Unit Chip. A single chip is generated after a trigger event.

SEQuence Unit Sequence Length. A single sequence is generated after a trigger event.

Example:

```
"SOUR:BB:WLAN:SEQ SING"
```
'sets trigger mode Single.

```
"SOUR:BB:WLAN:TRIG:SLUN FRAM"
```
'sets unit Frame for the entry of sequence length.

```
"SOUR:BB:WLAN:TRIG:SLEN 2"
```
'sets a sequence length of 2 frame. Two frames will be output after the next trigger event.

*RST value	Resolution	Options	SCPI
SEQuence	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TRIGger:SOURce INTernal | EXTernal | BEXTernal | OBASeband

The command selects the trigger source.

Parameter:

INTernal Triggering is executed by means of the Trigger command `SOURce<[1]|2>:BB:WLAN:TRIGger:EXECute` or `*TRG` in the case of remote control and by means of **Execute Trigger** in the case of manual operation.

EXTernal Triggering is executed by means of the signal on the TRIGGER 1 connector.

BEXTernal Triggering is executed by means of the signal on the TRIGGER 2 connector.

OBASeband Triggering is executed by means of the trigger signal from the second path (two-path instruments only).

Example:
```
"SOUR2:BB:WLAN:TRIG:SOUR EXT"
```
'sets external triggering via the TRIGGER 1 connector for path B of a two-path instrument .

*RST value	Resolution	Options	SCPI
INTernal	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:TTIMe 0 ... 1000 ns

The command sets the transition time. The transition time defines the overlap range of two OFDM symbols when time domain windowing is active. At a setting of 100 ns, one sample overlaps. This command is only available in physical layer mode OFDM (`SOURce:BB:WLAN:MODE OFDM`) and with active time domain windowing (`SOURce:BB:WLAN:TDWindowing:STATe ON`).

Example:
```
"BB:WLAN:TTIM 10 ns"
```
'sets a transition time of 10 ns.

*RST value	Resolution	Options	SCPI
100 ns	1 ns	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

SOURce-WLAN - PSDU Settings

The SOURce:BB:WLAN:PSDU system contains commands for setting the characteristics of the data packet on the physical layer (PPDU).

Command	Parameters	Default unit	Comments
[SOURce<[1]|2>:]BB:WLAN:PSDU:BRATe	6MBPS | 9MBPS | 12MBPS | 18MBPS | 24MBPS | 36MBPS | 48MBPS | 54MBPS		
[SOURce<[1]|2>:]BB:WLAN:PSDU:BSPReading:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WLAN:PSDU:DATA	PN9 | PN15 | PN16 | PN20 | PN21 | PN23 | ZERO | ONE | PATTern | DLISt		
[SOURce<[1]|2>:]BB:WLAN:PSDU:DATA:DSELect	<dlist_name>		
[SOURce<[1]|2>:]BB:WLAN:PSDU:DATA:PATTern	#B0,1...B11..1,64		
[SOURce<[1]|2>:]BB:WLAN:PSDU:DLENgth	4095 (Framed), 100000 (Unframed)	bytes	
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:ADDRess<1|2|3|4>	#H0000 0000 0000,48 ... #HFFFFFFFFFFFF,48		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:ADDRess<1|2|3|4>:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:DID	#H0000,16 ... #HFFFF,16		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol	#H0000,16 ... #HFFFF,16		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:FDS	#H0,1 ... #H1,1		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:MDATa	#H0,1 ... #H1,1		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:MFRagments	#H0,1 ... #H1,1		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:ORDer	#H0,1 ... #H1,1		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:PMANagement	#H0,1 ... #H1,1		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:PVERsion	#H0,1 ... #H1,1		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:RETRy	#H0,1 ... #H1,1		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:SUBType	#H0,1 ... #H1,1		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:TDS	#H0,1 ... #H1,1		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:TYPE	#H0,2 ... #H3,2		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:WEP	#H0,1 ... #H1,1		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCSequence:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:SCONtrol:FRAGment:INCRement	0 ... 1024		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:SCONtrol:FRAGment:STARt	#H0,1 ... #HF,4		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:SCONtrol:SEQuence:INCRement	0 ... 1024		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:SCONtrol:SEQuence:STARt	#H0,1 ... #HFFF,12		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:SCONtrol:STATe	ON | OFF		
[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:STATe	ON | OFF		

Command	Parameters	Default unit	Comments
[SOURce<[1]|2>:]BB:WLAN:PSDU:MODulation	BPSK |QPSK | QAM16 | M64 | DBPSK | DQPSK | CCK | PBCC		
[SOURce<[1]|2>:]BB:WLAN:PSDU:SCOunt	1...1378		

[SOURce<[1]|2>:]BB:WLAN:PSDU:BRATe
6MBPS | 9MBPS | 12MBPS | 18MBPS | 24MBPS | 36MBPS | 48MBPS | 54MBPS (OFDM) / 1MBPS | 2MBPS | 5.5MBPS | 11MBPS | 22MBPS (CCK|PBCC)

The command selects the bit rate of the PSDU. The available values depend on the selected physical layer mode. Value 1MBPS is available only for selection of long PLCP format in physical layer modes CCK and PBCC.

Example:
```
"BB:WLAN:MODE OFDM"          'selects physical layer mode OFDM.
"BB:WLAN:PSDU:BRAT 12MBPS"   'sets a bit rate of 12MBPS.
```

*RST value	Resolution	Options	SCPI
OFDM: 54MBPS CCK|PBCC: 11MBPS	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:BSPReading:STATe ON | OFF

The command activates/deactivates barker spreading. The command is only available only for selection of bit rates 1MBPS or 2 MBPS in physical layer modes CCK and PBCC.

Example:
```
"BB:WLAN:MODE CCK"           'selects physical layer mode CCK.
"BB:WLAN:PSDU:PLCP:FORM LONG" 'selects long PLCP format.
"BB:WLAN:PSDU:BRAT 1MBPS"    'sets a bit rate of 1MBPS.
"BB:WLAN:PSDU:BSPR:STAT OFF" 'deactivates barker spreading.
```

*RST value	Resolution	Options	SCPI
ON	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:DATA
PN9 | PN15 | PN16 | PN20 | PN21 | PN23 | DLISt | ZERO | ONE | PATTern

The command determines the data source for the data field.

Parameters:

PNxx The pseudo-random sequence generator is used as the data source. Different random sequence lengths can be selected.

DLISt A data list is used. The data list is selected with the command `:BB:WLAN:PSDU:DATA:DSELect`.

ZERO | ONE Internal 0 and 1 data is used

PATTern Internal data is used The bit pattern for the data is defined by the command `:BB:WLAN:PSDU:DATA:PATTern`.

Example:

```
"BB:WLAN:PSDU:DATA PATT"
```
'selects as the data source for the data fields of burst 0, the bit pattern defined with the following command.

```
"BB:WLAN:PSDU:DATA:PATT #H3F,8"
```
'defines the bit pattern.

*RST value	Resolution	Options	SCPI
PN9	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:DATA:DSELect <data list name>

The command selects the data list for the DLISt data source selection.

The lists are stored as files with the fixed file extensions ***.dm_iqd** in a directory of the user's choice. The directory applicable to the following commands is defined with the command `MMEMory:CDIR`. To access the files in this directory, you only have to give the file name, without the path and the file extension.

Example:

```
"BB:WLAN:PSDU:DATA DLIS"
```
'selects the Data Lists data source.

```
"MMEM:CDIR 'D:\Lists\DM\IqData'"
```
'selects the directory for the data lists.

```
"BB:WLAN:PSDU:MAC:DATA:DLIS 'wlan_list1'"
```
'selects file '`wlan_list1`' as the data source. This file must be in the directory `D:\Lists\DM\IqData` and have the file extension *.dm_iqd.

*RST value	Resolution	Options	SCPI
-	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:DATA:PATTern #B0,1... #B111..1,64

The command determines the bit pattern for the PATTern selection. The maximum length is 64 bits.

Example: "BB:WLAN:PSDU:DATA:PATT #H3F,8" 'defines the bit pattern.

*RST value	Resolution	Options	SCPI
0	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:DLENgth 0 ... 4095 Bytes (Framed), 100000 Bytes (Unframed)

The command sets the data length in bytes. In the framed mode, data field lengths of up to 4095 bytes are possible. This corresponds to the maximum data length. The unframed mode offers a data length of up to 100000 bytes.

Example: "BB:WLAN:PSDU:DLEN 256'" 'sets a data length of 256.

*RST value	Resolution	Options	Dependencies	SCPI
OFDM: 100 Bytes, CCK|PBCC: 1024 Bytes	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	If the data field length is changed, the generator calculates the number of OFDM data symbols as a function of the set PSDU bit rate (SOUR:BB:WLAN:PSDU:SCO) .	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:ADDRess<1|2|3|4>
#H000000000000,48 #HFFFFFFFFFFFF,48

The command enters the value of the address fields 1 ... 4. Exactly 48 bits must be entered. Each address is 6 bytes (48 bit) long. The addresses can be entered in hexadecimal form in the entry field of each address field. The least significant byte (LSB) is in left notation.

The MAC header can only be configured in framed mode (SOURce:BB:WLAN:SMODe FRAMed)

Example: "BB:WLAN:PSDU:MAC:ADDR2 #H124836C7EA54,48"
'set the value for address field 2.

*RST value	Resolution	Options	SCPI
#H000000000000,48		B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:ADDRess<1|2|3|4>:STATe ON | OFF

The command activates/deactivates the selected address field.

The MAC header can only be configured in framed mode (SOURce:BB:WLAN:SMODe FRAMed).

Example: "BB:WLAN:PSDU:MAC:ADDR2:STAT ON"
'activates generation of address field 2.

*RST value	Resolution	Options	SCPI
OFF		B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:DID #H0000,16 ... #HFFFF,16

The command enters the value of the duration Id field. Depending on the frame type, the 2-byte field Duration/ID is used to transmit the association identity of the station transmitting the frame or it indicates the duration assigned to the frame type. Exactly 16 bit must be entered.

The MAC header can only be configured in framed mode (SOURce:BB:WLAN:SMODe FRAMed)

Example: "BB:WLAN:PSDU:MAC:DID #HA5A5,16"
'sets the value of the duration Id field.

*RST value	Resolution	Options	SCPI
#H0000,16	-	B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol #H0000,16 ... #HFFFF,16

The command enters the value of the frame control field.The Frame control field has a length of 2 bytes (16 bits) and is used to define the protocol version, the frame type and its function, etc.. As an alternative, the individual bits can be set with the following commands.

The MAC header can only be configured in framed mode (SOURce:BB:WLAN:SMODe FRAMed).

Example: "BB:WLAN:PSDU:MAC:FCON #H100A,16"
'sets the value of the frame control field.

*RST value	Resolution	Options	SCPI
#H0000,16		B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:MDATa #H0,1 ... #H1,1

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:MFRagments #H0,1 ... #H1,1

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:ORDer #H0,1 ... #H1,1

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:PMANagement #H0,1 ... #H1,1

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCO Ntrol:PVERsion #H0,1 ... #H1,1

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:RETRy #H0,1 ... #H1,1

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:SUBType #H0,4 ... #HF,4#H1,1

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:TDS #H0,1 ... #H1,1

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:TYPE #H0,2 ... #H3,2

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCONtrol:WEP #H0,1 ... #H1,1

The command enters the value of the individual bits of the frame control field.

The MAC header can only be configured in framed mode (`SOURce:BB:WLAN:SMODe FRAMed`).

Example: `"BB:WLAN:PSDU:MAC:FCON:MDAT #H1,1"`
'sets the value of the More Data bit.

*RST value	Resolution	Options	SCPI
#H0,1		B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:FCSequence:STATe #H0000,16 ... #HFFFF,16

Activates/deactivates the calculation of the FCS (frame check sequence). The standard defines a 32-bit (4-byte) check sum to protect the MAC header and the user data (frame body).

The command is only available in framed mode (`SOURce:BB:WLAN:SMODe FRAMed`).

Example: `"BB:WLAN:PSDU:MAC:FCS:STAT ON"` 'activates the calculation of the FCS.

*RST value	Resolution	Options	SCPI
OFF		B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:SCONtrol:FRAGment:INCRement 0 ... 1024

Defines the number of packets required to increment the counter of the fragment bits of the sequence control.

The MAC header can only be configured in framed mode (SOURce:BB:WLAN:SMODe FRAMed).

Example: "BB:WLAN:PSDU:MAC:SCON:FRAG:INCR 2"
'two packets are required to increment the counter of the fragment bits.

*RST value	Resolution	Options	SCPI
1		B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:SCONtrol:FRAGment:STARt #H0,4 ... #HF,4

The command enters the start number of the fragment bits of the sequence control.

The MAC header can only be configured in framed mode (SOURce:BB:WLAN:SMODe FRAMed).

Example: "BB:WLAN:PSDU:MAC:SCON:FRAG:STAR #H4,4"
'sets the start value of the fragment bits of the sequence control

*RST value	Resolution	Options	SCPI
#H0,04		B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:SCONtrol:SEQuence:INCRement 0 ... 1024

Defines the number of packets required to increment the counter of the sequence bits of the sequence control.

The MAC header can only be configured in framed mode (SOURce:BB:WLAN:SMODe FRAMed).

Example: "BB:WLAN:PSDU:MAC:SCON:SEQ:INCR 2"
'two packets are required to increment the counter of the sequence bits.

*RST value	Resolution	Options	SCPI
1		B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:SCONtrol:SEQuence:STARt #H0,12 ... #HFFF,12

The command enters the start number of the fragment bits of the sequence control.

The MAC header can only be configured in framed mode (SOURce:BB:WLAN:SMODe FRAMed).

Example: "BB:WLAN:PSDU:MAC:SCON:SEQ:STAR #H4,4"
'sets the start value of the sequence bits of the sequence control

*RST value	Resolution	Options	SCPI
#H0,12		B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:SCONtrol:STATe ON | OFF

The command activates/deactivates the sequence control.

The MAC header can only be configured in framed mode (SOURce:BB:WLAN:SMODe FRAMed).

Example: "BB:WLAN:PSDU:MAC:SCON:STAT ON"
'activates the sequence control field.

*RST value	Resolution	Options	SCPI
OFF		B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:MAC:STATe ON | OFF

The command activates/deactivates the generation of the MAC Header.

The MAC header can only be configured in framed mode (SOURce:BB:WLAN:SMODe FRAMed).

Example: "BB:WLAN:PSDU:MAC:STAT ON" 'activates the generation of the MAC Header.

*RST value	Resolution	Options	SCPI
OFF		B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:MODulation

The command queries the modulation type. The modulation mode depends on the selected PSDU bit rate which depends on the selected physical layer mode (SOURce:BB:WLAN:MODE

The command is a query command and therefore has no *RST value.

Example: "BB:WLAN:PSDU:MOD?" 'queries the modulation mode.

Response: "DBPS"

*RST value	Resolution	Options	SCPI
-		B10/B11 and B13 K48 SOURce2 only with second option B10/B11	Device-specific

[SOURce<[1]|2>:]BB:WLAN:PSDU:SCOunt 1 ... 1378

The command sets the number of data symbols. If the number of OFDM data symbols is changed, the generator calculates the data field length as a function of the set PSDU bit rate.

The command is only available in physical layer mode OFDM (SOURce:BB:WLAN:MODE OFDM).

Example: "BB:WLAN:PSDU:SCO 5" 'sets the number of data symbols to 5.

*RST value	Resolution	Options	Dependencies	SCPI
4		B10/B11 and B13 K48 SOURce2 only with second option B10/B11	If the number of OFDM data symbols is changed, the generator calculates the data field length (SOUR:BB:WLAN:PSDU:DLEN) as a function of the set PSDU bit rate.	Device-specific

Index

P

R

S

T

U